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SITE-SPECIFIC TECHNICAL REPORT FOR BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA, MCGUIRE AFB, NEW JERSEY

DRAFT

PREPARED FOR:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
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SITE-SPECIFIC TECHNICAL REPORT (A003)

for

BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA, MCGUIRE AFB, NEW JERSEY

by

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for

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February 5, 1996

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Contract No. F41624-94-C-8012

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EXECUTIVE SUMMARY

This report summarizes the field activities conducted at McGuire AFB, for a short-term field pilot test to compare vacuum-enhanced free-product recovery (bioslurping) to traditional free-product recovery techniques to remove light, nonaqueous-phase liquid (LNAPL) from subsurface soils and aquifers. The field testing at McGuire AFB is part of the Bioslurper Initiative, which is funded and managed by the U.S. Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division. The AFCEE Bioslurper Initiative is a multisite program designed to evaluate the efficacy of the bioslurping technology for (1) recovery of LNAPL from groundwater and the capillary fringe, and (2) enhancing natural in situ degradation of petroleum contaminants in the vadose zone via bioventing.

The main objective of the Bioslurper Initiative is to develop procedures for evaluating the potential for recovering free-phase LNAPL present at petroleum-contaminated sites. The overall study is designed to evaluate bioslurping and identify site parameters that are reliable predictors of bioslurping performance. To measure LNAPL recovery in a wide variety of in situ conditions, tests are being performed at many sites. The test at McGuire AFB is one of at least 35 similar field tests to be conducted at various locations throughout the United States and its possessions.

The intent of field testing is to collect data to support determination of the predictability of LNAPL recovery and to evaluate the applicability, cost, and performance of the bioslurping technology for removal of free product and remediation of the contaminated area. The on-site testing is structured to allow direct comparison of the LNAPL recovery achieved by bioslurping with the performance of more conventional LNAPL recovery technologies. The test method included an initial site characterization followed by LNAPL recovery testing. The three LNAPL recovery technologies tested at McGuire AFB were skimmer pumping, bioslurping, and drawdown pumping.

Site characterization activities were conducted to evaluate site variables that could affect LNAPL recovery efficiency and to determine the bioventing potential of the site. Testing included baildown testing, soil sampling, soil gas permeability testing, and in situ respiration testing.

Following the site characterization activities, the pilot tests for skimmer pumping, bioslurping, and drawdown pumping were conducted. The LNAPL recovery testing was conducted in the following sequence: 46 hours in the skimmer configuration, approximately 89 hours in the bioslurper configuration, an additional 24 hours in the skimmer configuration, and approximately 37 hours in the drawdown configuration. Measurements of extracted soil gas composition, LNAPL thickness, and

groundwater level were taken throughout the testing. The volume of LNAPL recovered and groundwater extracted were quantified over time.

Skimmer and drawdown pumping were not as effective as bioslurping at recovering LNAPL from this site. Free product recovery rates decreased steadily during skimmer pumping, beginning at a rate of approximately 9.5 gallons/day during the initial skimmer pump test and decreasing to approximately 2.3 gallons/day by the end of the test. During drawdown pumping, LNAPL recovery rates averaged 1.2 gallons/day. In contrast, free product recovery rates during the bioslurper pump test remained relatively stable at an average of approximately 30 gallons/day.

Groundwater recovery rates during the bioslurper pump test were high in comparison to rates during the skimmer and drawdown pump tests. On average, groundwater was extracted at rates of 4,600 gallons/day during bioslurping, 92 gallons/day during skimming, and 730 gallons/day during drawdown pumping.

Soil gas concentrations were measured at monitoring points during the bioslurper pump test to determine whether the vadose zone was being oxygenated. In general, oxygen concentrations increased at most monitoring points; however, due to the high soil moisture content, soil gas samples were difficult to collect and an adequate evaluation of the oxygen radius of influence could not be made. Because of the high soil moisture content, it was not possible to determine a pressure radius of influence.

Implementation of bioslurping at the McGuire AFB test site probably would facilitate enhanced recovery of LNAPL from the water table. However, bioslurping will result in a vapor stream requiring treatment and the extraction of significant quantities of groundwater. Given the treatment options of an ICE for vapors and discharge of extracted groundwater to the Industrial Wastewater Treatment Plant, bioslurping would be an economically viable alternative for this site.

DRAFT SITE-SPECIFIC TECHNICAL REPORT (A003)

for

BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA, MCGUIRE AFB, NEW JERSEY

February 5, 1996

1.0 INTRODUCTION

This report describes activities performed and data collected during a field test at McGuire Air Force Base (AFB), New Jersey, to compare vacuum-enhanced free-product recovery (bioslurping) to traditional free-product recovery technologies for removal of light, nonaqueous-phase liquid (LNAPL) from subsurface soils and aquifers. The field testing at McGuire AFB is part of the Bioslurper Initiative, which is funded and managed by the U.S. Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division. The AFCEE Bioslurper Initiative is a multisite program designed to evaluate the efficacy of the bioslurping technology for (1) recovery of LNAPL from groundwater and the capillary fringe and (2) enhancing natural in situ degradation of petroleum contaminants in the vadose zone via bioventing.

1.1 Objectives

The main objective of the Bioslurper Initiative is to develop procedures for evaluating the potential for recovering free-phase LNAPL present at petroleum-contaminated sites. The overall study is designed to evaluate bioslurping and identify site parameters that are reliable predictors of bioslurping performance. To measure LNAPL recovery in a wide variety of in situ conditions, tests are being performed at many sites. The test at McGuire AFB is one of at least 35 similar field tests to be conducted at various locations throughout the United States and its possessions. Aspects of the testing program that apply to all sites are described in the *Test Plan and Technical Protocol for Bioslurping* (Battelle, 1995). Test provisions specific to activities at McGuire AFB were described in the Site-Specific Test Plan provided in Appendix A.

The intent of field testing is to collect data to support determination of the predictability of LNAPL recovery and to evaluate the applicability, cost, and performance of the bioslurping

technology for removal of free product and remediation of the contaminated area. The on-site testing is structured to allow direct comparison of the LNAPL recovery achieved by bioslurping with the performance of more conventional LNAPL recovery technologies. The test method included an initial site characterization followed by LNAPL recovery testing. The three LNAPL recovery technologies tested at McGuire AFB were skimmer pumping, bioslurping, and drawdown pumping. The specific test objectives, methods, and results for the McGuire AFB test program are discussed in the following sections.

1.2 Testing Approach

Site characterization activities were conducted to evaluate site variables that could affect LNAPL recovery efficiency and to determine the bioventing potential of the site. Testing included baildown testing to evaluate the mobility of LNAPL, soil sampling to determine physical/chemical site characteristics, soil gas permeability testing to determine the radius of influence, and in situ respiration testing to evaluate site microbial activity.

Following the site characterization activities, the pilot tests for skimmer pumping, bioslurping, and drawdown pumping were conducted. The LNAPL recovery testing was conducted in the following sequence: 46 hours in the skimmer configuration, approximately 89 hours in the bioslurper configuration, an additional 24 hours in the skimmer configuration, and approximately 37 hours in the drawdown configuration. Measurements of extracted soil gas composition, LNAPL thickness, and groundwater level were taken throughout the testing. The volume of LNAPL recovered and groundwater extracted were quantified over time.

2.0 SITE DESCRIPTION

McGuire AFB is located in the south-central portion of New Jersey. The installation is bordered by the Fort Dix Military Reservation to the east, south, and west, and by residential areas of the Town of Wrightstown (Burlington County), New Jersey to the north.

The Bulk Fuel Storage Area is in the central portion of McGuire AFB and occupies approximately 24 acres (Figure 1). The facility consists of a series of eight aboveground storage tanks with capacities ranging from 500,000 to 850,000 gallons. Five of these tanks are dedicated to

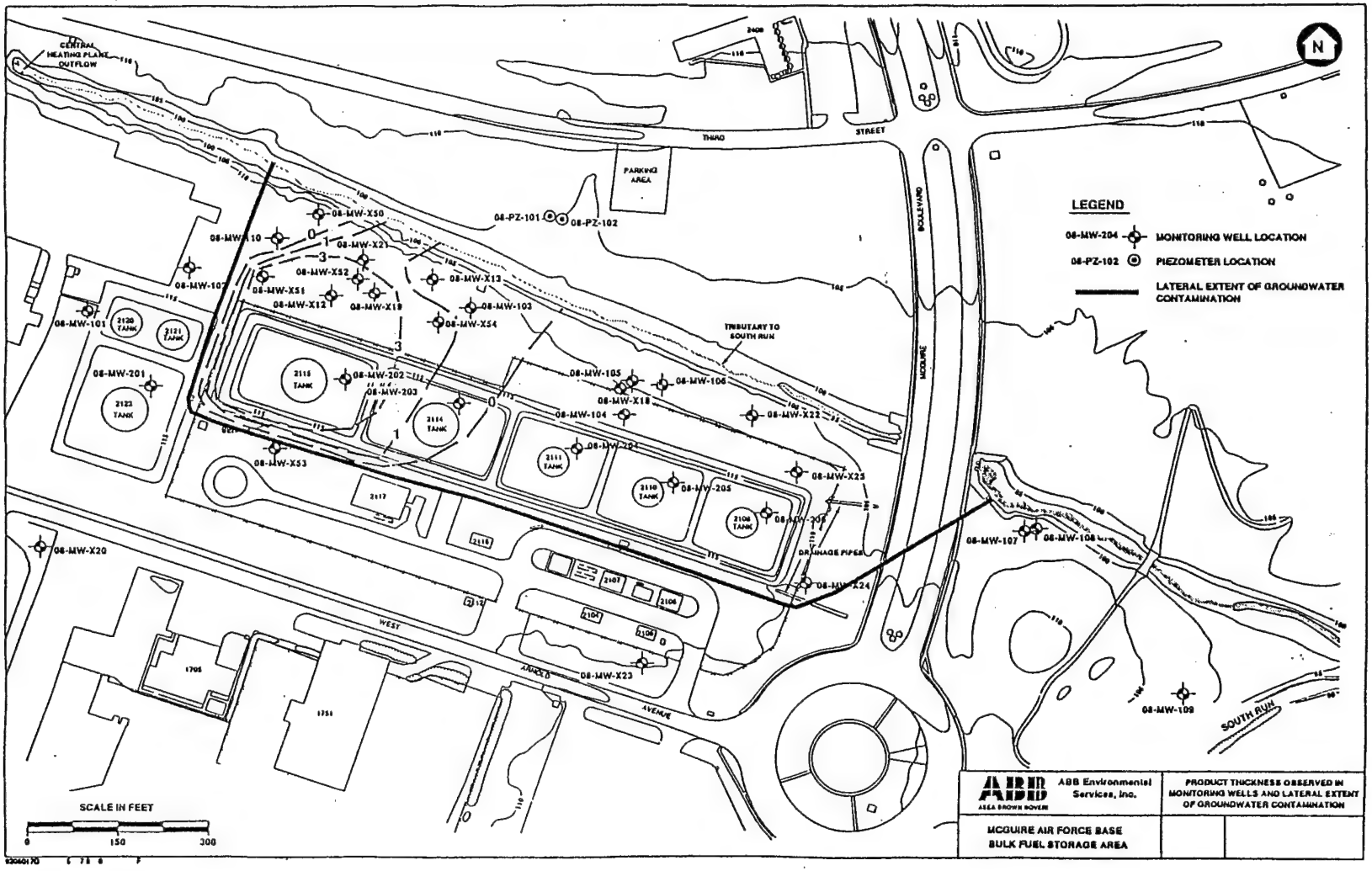

Figure 1. **Schematic Diagram Showing Monitoring well Locations and the Lateral Extent of Groundwater Contamination and Free-Product Thicknesses at the Bulk Fuel Storage Area, McGuire AFB, NJ**

JP-4 jet fuel storage while the remaining tanks hold heating fuel for the central heating plant. All of the tanks are contained by an asphalt-covered earthen berm.

McGuire AFB rests on coastal plain sediments. The shallow stratigraphy consists primarily of interbedded continental and marine sands and silts. The thickness of these units vary, with each being up to 50 ft thick in the general area of McGuire AFB. Site soils consist primarily of silty fine sands, interspersed with silt laminae and gravel seams. An organic silt layer with wood fragments and rootlets is present across the site between 11 and 14 ft below ground surface (bgs). Groundwater is part of the unconfined Cohansey/Kirkwood aquifer system and generally is found between 8 and 14 ft bgs across the site. This shallow aquifer is not used for consumptive purposes on the base.

The Bulk Fuel Storage Area has been in operation since 1963. During this time, fuel spills and storage/disposal activities have resulted in contamination at the site. In 1967, 500,000 gallons of JP-4 jet fuel were discharged from an open valve (location unknown, spill reportedly channelled to stream). In 1984, 500,000 gallons of JP-4 jet fuel were released from a ruptured underground pipeline northeast of Tank 2109. In 1987, 10,000 gallons of JP-4 jet fuel were spilled into the berm of Tank 2110. In 1988, an unspecified volume of heating oil was discharged north of Tanks 2120 and 2121. Finally, up until 1970, tank sludge was disposed of in the tank bermed areas, and fly ash and coal slag were stored and disposed north of the tank area.

In 1992, fuel was observed discharging from a subsurface organic silt layer into the unnamed tributary of South Run. The water in this unnamed tributary comes from shallow groundwater discharges, storm drain runoff, and cooling water discharge from the central heating plant.

Preliminary investigations of the site occurred in 1982, followed by site inspections in 1983 and 1988. During this time, monitoring wells were installed, groundwater samples were collected, and a pump test was performed. From 1990 to 1992, remedial investigations were performed to assess the extent of contamination.

Soil samples, both surface and subsurface, have been collected and analyzed for the presence of organic contamination. Benzene, toluene, ethylbenzene, and xylenes (BTEX) as well as semivolatile organic compounds (SVOCs) have been identified in a portion of the soil samples. Generally, the concentration levels or the frequency of occurrence indicated that the compounds identified did not exceed the New Jersey Department of Environmental Protection and Energy's (NJDEPE) proposed cleanup standards. The data do indicate that the contaminants are those typically associated with fuel spills and are therefore considered site related.

Soil gas samples collected in 1992 showed high BTEX and total petroleum hydrocarbon (TPH) concentrations, with average BTEX concentrations of 360 ppmv and average TPH concentrations of 54,000 ppmv.

Groundwater samples have been collected from locations upgradient and downgradient of the Bulk Fuel Storage Area. The upgradient monitoring wells included: 08-MW-X20, 08-MW-X23, 08-MW-X24, 08-MW-101, and 08-MW-201. A total of 20 downgradient wells were sampled to establish the extent of groundwater contamination. Monitoring wells that contained LNAPL were not sampled.

LNAPL measurements have been made at the monitoring points at the Bulk Fuel Storage Area. Product thickness measurements are presented in Table 1. The distribution of LNAPL indicates that the thickest subsurface layer of organic contamination resides north of Tank 2115. It is in this location that the demonstration of the bioslurper technology is expected to take place. One of the existing monitoring wells (08-MW-X12, 08-MW-X19, or 08-MW-X51) is expected to be used for the LNAPL extraction.

Table 1. Free Product Thicknesses at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Well	Free Product Thickness (ft)	
	5/30/91	6/22/94
08-MW-X12	4.44	4.69
08-MW-X18	2.46	2.85
08-MW-X19	6.71	5.37
08-MW-X21	3.01	2.46
08-MW-X51	1.61	3.27
08-MW-X54	0.12	0.04

3.0 BIOSLURPER SHORT-TERM PILOT TEST METHODS

This section documents the initial conditions at the test site and describes the test equipment and methods used for the short-term pilot test at McGuire AFB.

3.1 Initial LNAPL/Groundwater Measurements and Baildown Testing

Monitoring wells 08-MW-19, 08-MW-12, and 08-MW-51 were evaluated for use in the bioslurper pilot testing. Initial depths to LNAPL and to groundwater were measured using an oil/water interface probe (ORS Model #1068013). LNAPL was removed from the well with a Teflon™ bailer until the LNAPL thickness could no longer be reduced. The rate of increase in the thickness of the floating LNAPL layer was monitored for approximately 17 hours using the oil/water interface probe.

3.2 Well Construction Details

Existing monitoring well 08-MW-19 was selected for use in the bioslurper pilot testing. The well is constructed of 4-inch-diameter, schedule 40 polyvinyl chloride (PVC) with a total depth of 20.5 ft and a screen interval extending from 5.5 to 20.5 ft. A schematic diagram illustrating well construction details is provided in Figure 2.

3.3 Soil Gas Monitoring Point Installation

On November 11, 1995, three monitoring points were installed in the area of monitoring well 08-MW-19 and were labeled MPA, MPB, and MPC. The locations and construction details of the monitoring points are illustrated in Figure 2.

The monitoring points consisted of sets of ¼-inch tubing, with 1-inch-diameter, 6-inch-long screened areas. The screened lengths were positioned at the appropriate depths, and the annular space corresponding to the screened length was filled with silica sand. The interval between the screened lengths was filled with bentonite clay chips, as was the space from the top of the shallowest screened length to the ground surface. After placement, the bentonite clay was hydrated with water to expand the chips and provide a seal. The monitoring points were installed at depths as follows:

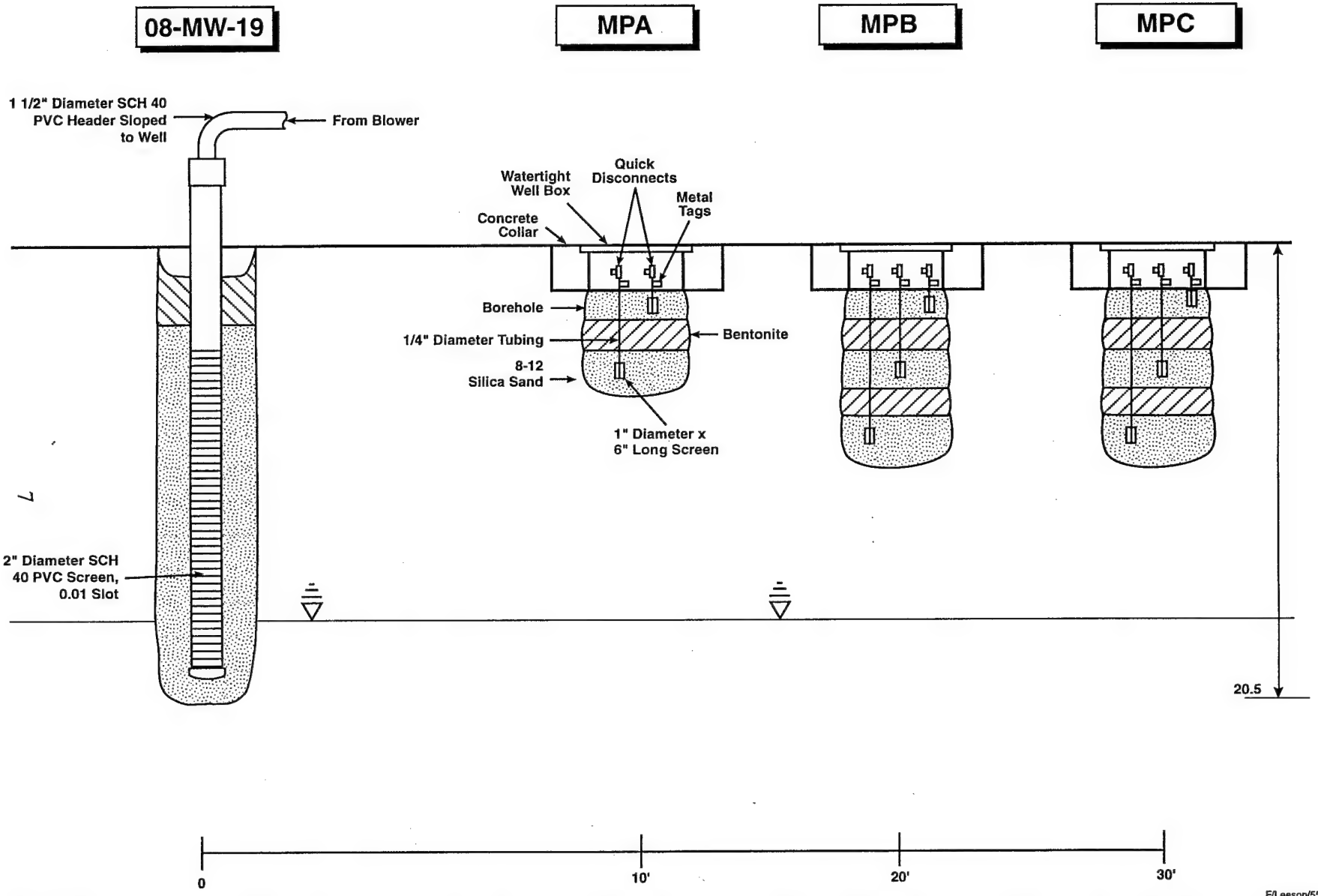

Figure 2. Schematic Diagram Illustrating Site Lithology and Construction Details of the Bioslurper Well and Soil Gas Monitoring Points at the Bulk Fuel Storage Area, McGuire AFB, NJ

- Monitoring point MPA was installed at a depth of 5.8 ft into a 6-inch diameter borehole. The monitoring point was screened to two depths: 3.0 and 5.8 ft.

- Monitoring point MPB was installed at a depth of 9.0 ft into a 6-inch diameter borehole. The monitoring point was screened to three depths: 3.0, 6.0, and 9.0 ft.

- Monitoring point MPC was installed at a depth of 9.0 ft into a 6-inch diameter borehole. The monitoring point was screened to three depths: 2.5, 6.0, and 9.0 ft.

After installation of the monitoring points, initial soil gas measurements were taken with a GasTechtor portable O_2/CO_2 meter and a GasTech Trace-Techtor portable hydrocarbon meter. In general, oxygen limitation was observed at shallower depths, with oxygen concentrations in the range of 4.5 to 4.8% found at a depth of 3.0 ft (Table 2).

Table 2. Initial Soil Gas Compositions at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Point	Depth (ft)	Oxygen (%)	Carbon Dioxide (%)	TPH (ppmv)
MPA	3.0	4.8	1.5	480
	6.0	20.9	0.050	140
MPB	3.0	4.5	2.5	640
	6.0	NM	NM	NM
	9.0	NM	NM	NM
MPC	2.5	19.0	0.40	190
	6.0	20.0	0.50	1,500
	9.0	18.0	2.5	2,000

NM = Not measured. High moisture content resulted in difficulties obtaining soil gas samples.

3.4 Soil Sampling and Analysis

Three soil samples were collected during the installation of monitoring point MPA. The soil samples were collected in brass sleeves driven down the center of the hollow-stem auger used to drill the monitoring well. The samples were collected at depths of 9.0 to 9.5 ft, 9.5 to 10 ft, and 10 to 10.5 ft and were labeled MG-S-1, MG-S-2, and MG-S-3, respectively. The samples were placed in insulated coolers, chain-of-custody records and shipping papers were completed, and the samples were sent to Alpha Analytical, Inc., in Sparks, Nevada by overnight express. All samples were analyzed for BTEX, bulk density, moisture content, particle size, porosity, and TPH. Laboratory analytical reports for all samples are provided in Appendix B.

3.5 LNAPL Recovery Testing

3.5.1 System Setup

The bioslurping pilot test system is a trailer-mounted mobile unit. The vacuum pump (Atlantic Fluidics Model A100, 7.5-hp liquid ring pump), oil/water separator, and required support equipment are carried to the test location on a trailer. The trailer was located near monitoring well 08-MW-19, the well cap was removed, a coupling and tee were attached to the top of the well, and the slurper tube was lowered into the well. The slurper tube was attached to the vacuum pump. Different configurations of the tee and the placement depth of the slurper tube allow for simulation of skimmer pumping, operation in the bioslurping configuration, or simulation of drawdown pumping as described in Sections 3.5.2, 3.5.3, and 3.5.5, respectively.

An internal combustion engine (ICE) was used to treat the bioslurper system off-gas. Data from the ICE operation is provided in Appendix C. Extracted groundwater was treated by passing the effluent through an oil/water separator and into a 1,500 gallon settling tank. After settling, the effluent was released into the sanitary sewer.

A brief system startup test was performed prior to LNAPL recovery testing to ensure that all system components were working properly. The system checklist is provided in Appendix D. All site data and field testing information were recorded in a field notebook and then transcribed onto pilot test data sheets provided in Appendix E.

3.5.2 Initial Skimmer Pump Test

Prior to test initiation, depths to LNAPL and groundwater were measured. The slurper tube was then set at the LNAPL/groundwater interface with the wellhead open to the atmosphere via a PVC connecting tee (Figure 3). The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 11, 1995, to begin the skimmer pump test. The test was operated continuously for approximately 46 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the skimmer pump test. Test data sheets are provided in Appendix E.

3.5.3 Bioslurper Pump Test

Upon completion of the skimmer pump test, preparations were made to begin the bioslurper pump test. Prior to test initiation, depths to LNAPL and groundwater were measured. The slurper tube was then set at the LNAPL/groundwater interface, as in the skimmer pump test. However, in contrast to the skimmer pump test, the PVC connecting tee was removed, sealing the wellhead and allowing the pump to establish a vacuum in the well (Figure 4). A pressure gauge was installed at the wellhead to measure the vacuum inside the extraction well. The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 12, 1995, to begin the bioslurper pump test. The test was initiated approximately 5 hours after the skimmer pump test and was operated continuously for approximately 89 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the bioslurper pump test. Test data sheets are provided in Appendix E.

An LNAPL sample was collected approximately 3 hours after initiation of the bioslurper test and was labeled MG-F-1. The sample was sent to Alpha Analytical, Inc., Sparks, Nevada for analysis of BTEX, TPH, and boiling point fractionation.

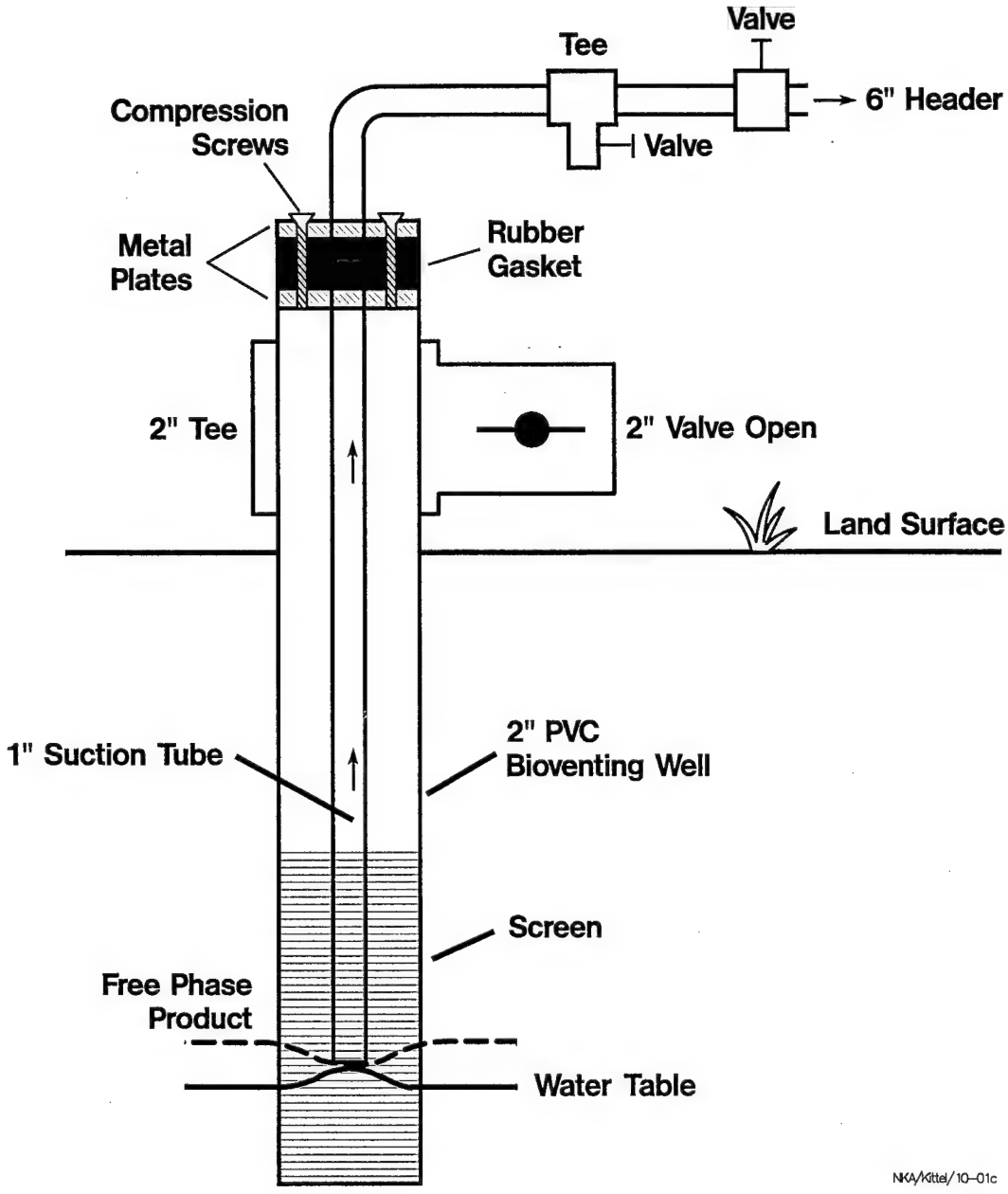

Figure 3. Slurper Tube Placement and Valve Position for the Skimmer Pump Test

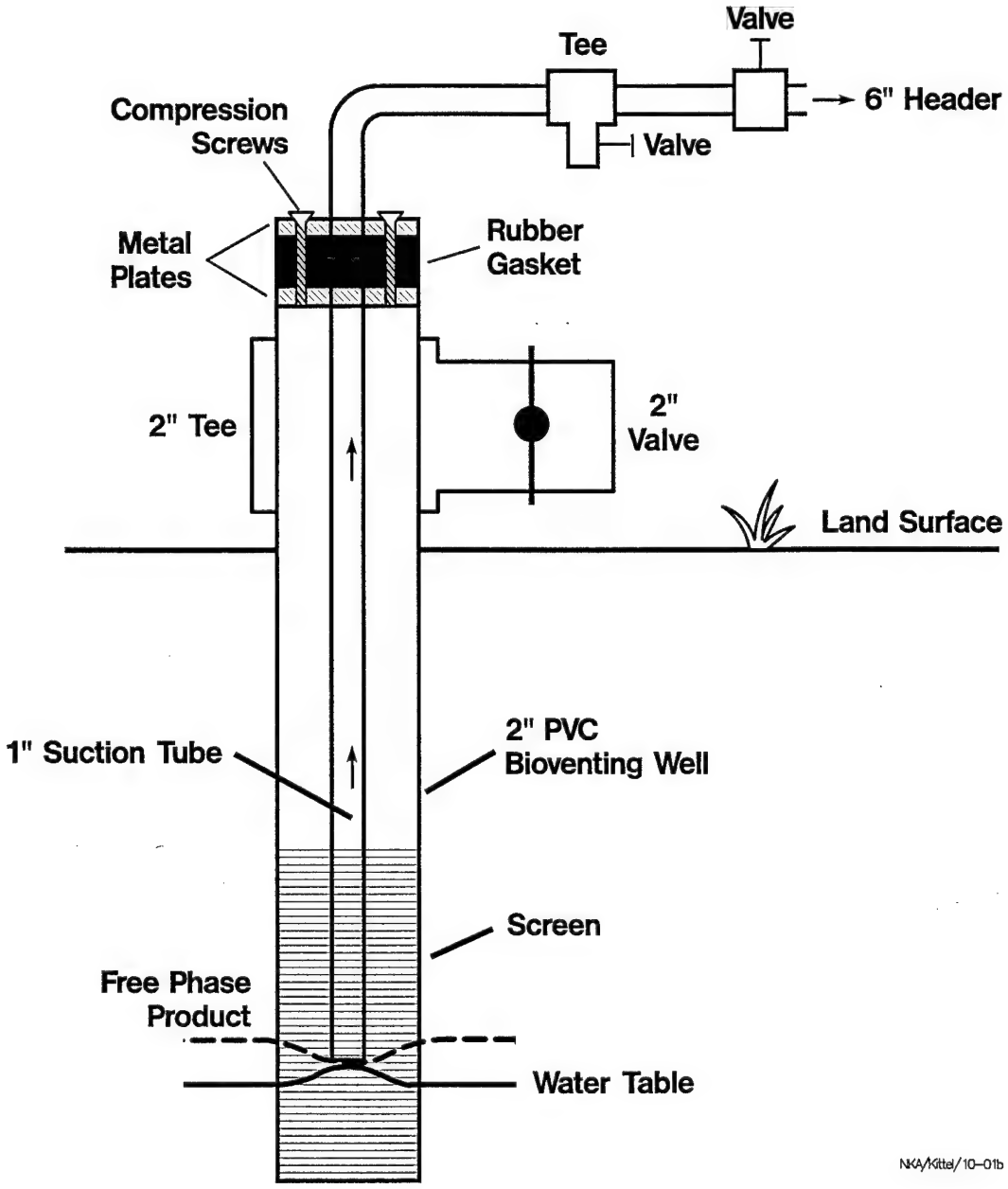

Figure 4. Slurper Tube Placement and Valve Position for the Bioslurper Pump Test

3.5.4 Second Skimmer Pump Test

Upon completion of the bioslurper pump test, preparations were made to begin the second skimmer pump test. Prior to test initiation, depths to LNAPL and groundwater were measured. The valve and slurper tube configuration were identical to that used for the initial skimmer pump test. The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 16, 1995, to begin the second skimmer pump test. The test was initiated approximately 1 hour after the bioslurper pump test and was operated continuously for 24 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the bioslurper pump test. Test data sheets are provided in Appendix E.

3.5.5 Drawdown Pump Test

Upon completion of the second skimmer pump test, preparations were made to begin the drawdown pump test. Prior to test initiation, depths to LNAPL and groundwater were measured. The slurper tube was then set so that the tip was 36 inches below the oil/water interface with the PVC connecting tee open to the atmosphere (Figure 5). The liquid ring pump and oil/water separator were primed with known amounts of groundwater to ensure that any LNAPL or groundwater entering the system could be quantified. The flow totalizers for the LNAPL and aqueous effluent were zeroed, and the liquid ring pump was started on November 17, 1995, to begin the drawdown pump test. The test was initiated approximately 2 hours after the second skimmer pump test and was operated continuously for 37 hours. The LNAPL and groundwater extraction rates were monitored throughout the test, as were all other relevant data for the drawdown pump test. Test data sheets are provided in Appendix E.

3.5.6 Off-Gas Sampling and Analysis

Soil gas samples were collected from the bioslurper off-gas during the bioslurper pump test. Duplicate samples were collected in Summa™ canisters prior to and after treatment through the ICE. Samples labeled MG-LRP Reservoir-1 and MG-LRP Reservoir-2 were taken from the liquid ring

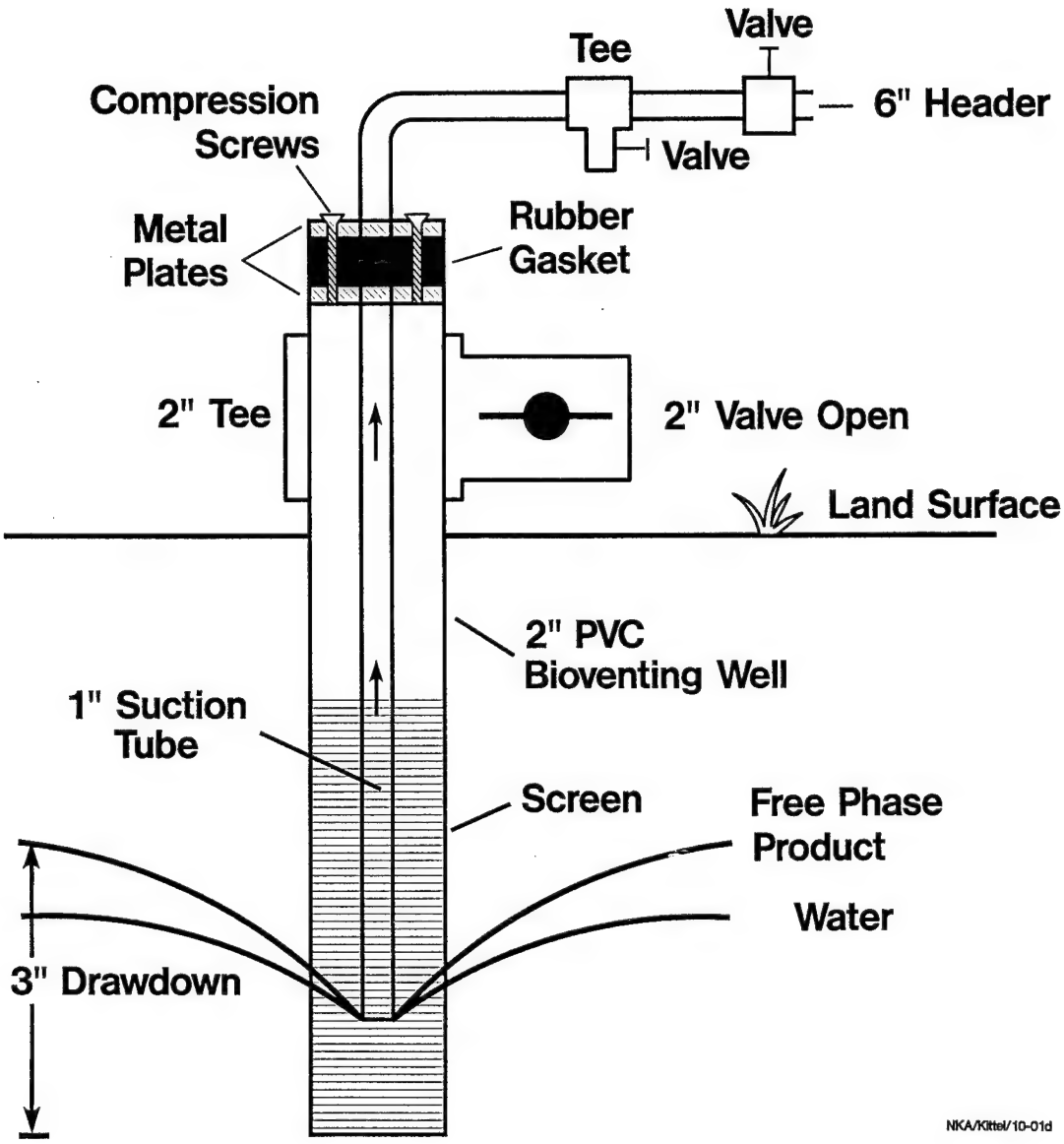

Figure 5. Slurper Tube Placement and Valve Position for the Drawdown Pump Test

pump reservoir and samples labeled MG-LRP Stack-1 and MG-LRP Stack-2 were taken from the stack of the liquid ring pump where ambient air was being taken in. All four of these samples were taken prior to ICE treatment. Samples labeled MG-ICE Stack-1 and MG-ICE Stack-2 were taken following ICE treatment. The samples were sent under chain of custody to Air Toxics, Ltd., in Rancho Cordova, California, for analyses of BTEX and TPH.

3.5.7 Groundwater Sampling and Analysis

Two groundwater samples were collected during the bioslurper pump test. One sample was collected from the discharge of the oil/water separator surge tank and was labeled MG-OWS-1. Another sample was collected from the effluent of the 1,500 gallon tank being discharged into the sanitary sewer and was labeled MG-Discharge-1. Samples were collected in 40-mL septa vials containing HCl preservative. Samples were checked to ensure no headspace was present and were then shipped on ice and sent under chain of custody to Alpha Analytical, Inc., in Sparks, Nevada for analyses of BTEX and TPH.

3.6 Soil Gas Permeability Testing

The soil gas permeability test data were collected during the bioslurper pump test. Before a vacuum was established in the extraction well, the initial soil gas pressures at the three installed monitoring points were recorded. The start of the bioslurper pump test created a steep pressure drop in the extraction well which was the starting point for the soil gas permeability testing. Soil gas pressures were measured at each of the three monitoring points at all depths to track the rate of outward propagation of the pressure drop in the extraction well. The soil gas pressures were recorded throughout the bioslurper pump test to determine the bioventing radius of influence. Test data are provided in Appendix F.

3.7 In Situ Respiration Testing

Air containing approximately 1.0% helium was injected into four monitoring points for approximately 24 hours beginning on November 17, 1995. The setup for the in situ respiration test is described in the *Test Plan and Technical Protocol a Field Treatability Test for Bioventing* (Hinchee et

al., 1992). A ½-hp diaphragm pump was used for air and helium injection. Air and helium were injected through the following monitoring points at the depths indicated: MPA-6.0′, MPB-9.0′, MPC-6.0′, and MPC-9.0′. After the air/helium injection was terminated, soil gas concentrations of oxygen, carbon dioxide, TPH, and helium were monitored periodically. The respiration test was terminated on November 18, 1995. Oxygen utilization and biodegradation rates were calculated as described in Hinchee et al. (1992). Raw data for these tests are presented in Appendix G.

Helium concentrations were measured during the in situ respiration test to quantify helium leakage to or from the surface around the monitoring points. Helium loss over time is attributable to either diffusion through the soil or leakage. A rapid drop in helium concentration usually indicates leakage. A gradual loss of helium along with a first-order curve generally indicates diffusion. As a rough estimate, the diffusion of gas molecules is inversely proportional to the square root of the molecular weight of the gas. Based on molecular weights of 4 for helium and 32 for oxygen, helium diffuses approximately 2.8 times faster than oxygen, or the diffusion of oxygen is 0.35 times the rate of helium diffusion. As a general rule, we have found that if helium concentrations at test completion are at least 50 to 60% of the initial levels, measured oxygen uptake rates are representative. Greater helium loss indicates a problem, and oxygen utilization rates are not considered representative.

4.0 RESULTS

This section documents the results of the site characterization, the comparative LNAPL recovery pump test, and other supporting tests conducted at McGuire AFB.

4.1 Baildown Test Results

Results from baildown tests in monitoring wells 08-MW-19, 08-MW-12, and 08-MW-51 are presented in Table 3. The LNAPL thickness in 08-MW-19 recovered most rapidly of the three wells by the end of the 17-hour test period. Based on the amount of free product recovered and free product thickness, monitoring well 08-MW-19 was selected for the bioslurper field testing.

Table 3. Results of Baildown Testing in Monitoring Wells 08-MW-19, 08-MW-12 and 08-MW-51

Monitoring Well	Date-Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
08-MW-19	Initial Reading 11/9/95-1415	16.80	12.89	3.91
	11/9/95-1418	14.76	14.70	0.06
	11/9/95-1419	14.57	14.42	0.15
	11/9/95-1422	14.42	14.25	0.17
	11/9/95-1431	14.25	13.94	0.31
	11/9/95-1443	14.22	13.80	0.42
	11/9/95-1451	14.25	13.75	0.50
	11/9/95-1520	14.38	13.68	0.70
	11/9/95-1608	14.52	13.62	0.90
	11/9/95-1716	14.72	13.56	1.16
	11/9/95-1942	15.00	13.47	1.53
	11/10/95-0744	15.59	13.29	2.30
08-MW-12	Initial Reading 11/9/95-1440	16.11	13.15	2.96
	11/9/95-1445	15.33	15.13	0.20
	11/9/95-1447	15.26	14.91	0.35
	11/9/95-1450	15.16	14.75	0.41
	11/9/95-1455	14.97	14.42	0.55
	11/9/95-1516	15.57	13.90	1.67
	11/9/95-1610	14.43	13.70	0.73
	11/9/95-1717	14.47	13.67	0.80
	11/9/95-1944	14.53	13.65	0.88
	11/10/95-0745	14.65	13.60	1.05
08-MW-51	Initial Reading 11/9/95-1535	17.32	13.39	3.93
	11/9/95-1538	16.45	16.37	0.08
	11/9/95-1540	16.08	16.00	0.08
	11/9/95-1549	15.33	15.22	0.11
	11/9/95-1611	14.68	14.45	0.23
	11/9/95-1720	14.52	14.27	0.25
	11/9/95-1945	14.61	14.24	0.37
	11/10/95-0747	14.78	14.18	0.60

4.2 Soil Sample Analyses

Table 4 shows the BTEX and TPH concentrations measured in soil samples collected from the Bulk Fuel Storage Area. BTEX and TPH concentrations were relatively low, with an average total BTEX concentration of 5.4 mg/kg and an average TPH concentration of 140 mg/kg. Benzene was below 1 mg/kg in all samples. The results of the physical characterization of the soils are presented in Table 5.

4.3 LNAPL Pump Test Results

4.3.1 Initial Skimmer Pump Test Results

The LNAPL thickness prior to the initial skimmer pump test was 13.29 ft (Table 6). A total of 11 gallons of LNAPL was recovered during this test, with an average recovery rate of 5.9 gallons/day (Table 7). A total of 180 gallons of groundwater was extracted with an average extraction rate of 92 gallons/day (Table 7). Results of LNAPL recovery versus time are shown in Figure 6.

4.3.2 Bioslurper Pump Test Results

LNAPL recovery rates increased significantly during the bioslurper pump test (Figure 8). The increase in recovery rate indicates that LNAPL was mobilized to the extraction well under vacuum-enhanced conditions. A total of 110 gallons of LNAPL and 17,000 gallons of groundwater were extracted during the bioslurper pump test, with daily average recovery rates of 30 gallons/day for LNAPL and 4,600 gallons/day for groundwater (Table 7). The LNAPL recovery rate versus time is shown in Figure 7. The vacuum-exerted wellhead pressure on monitoring well 08-MW-19 was kept relatively constant throughout the bioslurper pump test at approximately 12 inches of mercury.

Soil gas concentrations were measured at monitoring points during the bioslurper pump test to determine whether the vadose zone was being oxygenated. In general, oxygen concentrations increased at most monitoring points (Table 8); however, due to the high soil moisture content, soil gas samples were difficult to collect and an adequate evaluation of the oxygen radius of influence could not be made.

Table 4. **BTEX and TPH Concentrations in Soil Samples from the Bulk Fuel Storage Area, McGuire AFB, NJ**

Parameter	Concentration (mg/kg)		
	MG-S-1	MG-S-2	MG-S-3
TPH as jet fuel	58	<10	360
Benzene	0.12	0.033	<0.40
Toluene	0.29	0.061	1.2
Ethylbenzene	0.30	0.061	1.6
Xylenes	1.9	0.39	10

Table 5. **Physical Characterization of Soil from the Bulk Fuel Storage Area, McGuire AFB, NJ**

Parameter		Sample		
		MG-S-1	MG-S-2	MG-S-3
Moisture Content (%)		21.7	24.5	26.1
Porosity (%)		54.3	48.7	51.3
Specific Gravity (g/cm^3)		1.21	1.36	1.29
Particle Size	Gravel (%)	0	0	0
	Sand (%)	78	88	82
	Silt (%)	15	5	10
	Clay (%)	7	7	8

Table 6. Depths to Groundwater and LNAPL Prior to Each Pump Test

Test	Test Start Date	Depth to LNAPL (ft)	Depth to Groundwater (ft)	LNAPL Thickness (ft)
Initial Skimmer Pump Test	11/10/95	13.29	15.59	2.30
Bioslurper Pump Test	11/12/95	13.64	13.86	0.22
Second Skimmer Pump Test	11/16/95	15.95	15.96	0.010
Drawdown Test	11/17/95	No fuel detected	13.33	0

Table 7. Pump Test Results at the Bulk Fuel Storage Area, McGuire AFB, NJ

Recovery Rate (gal/day)	Initial Skimmer Pump Test		Bioslurper Pump Test		Second Skimmer Pump Test		Drawdown Pump Test	
	LNAPL	Groundwater	LNAPL	Groundwater	LNAPL	Groundwater	LNAPL	Groundwater
Day 1	9.5	53	1.6	4,900	6.6	110	1.1	350
Day 2	2.3	130	47	3,100	NA	NA	1.3	1,100
Day 3	NA	NA	24	5,400	NA	NA	NA	NA
Day 4	NA	NA	45	5,100	NA	NA	NA	NA
Average	5.9	92	30.0	4,600	6.6	110	1.2	730
Total Recovery (gal)	11	180	110	17,000	6.6	110	1.8	1100

NA = Not applicable.

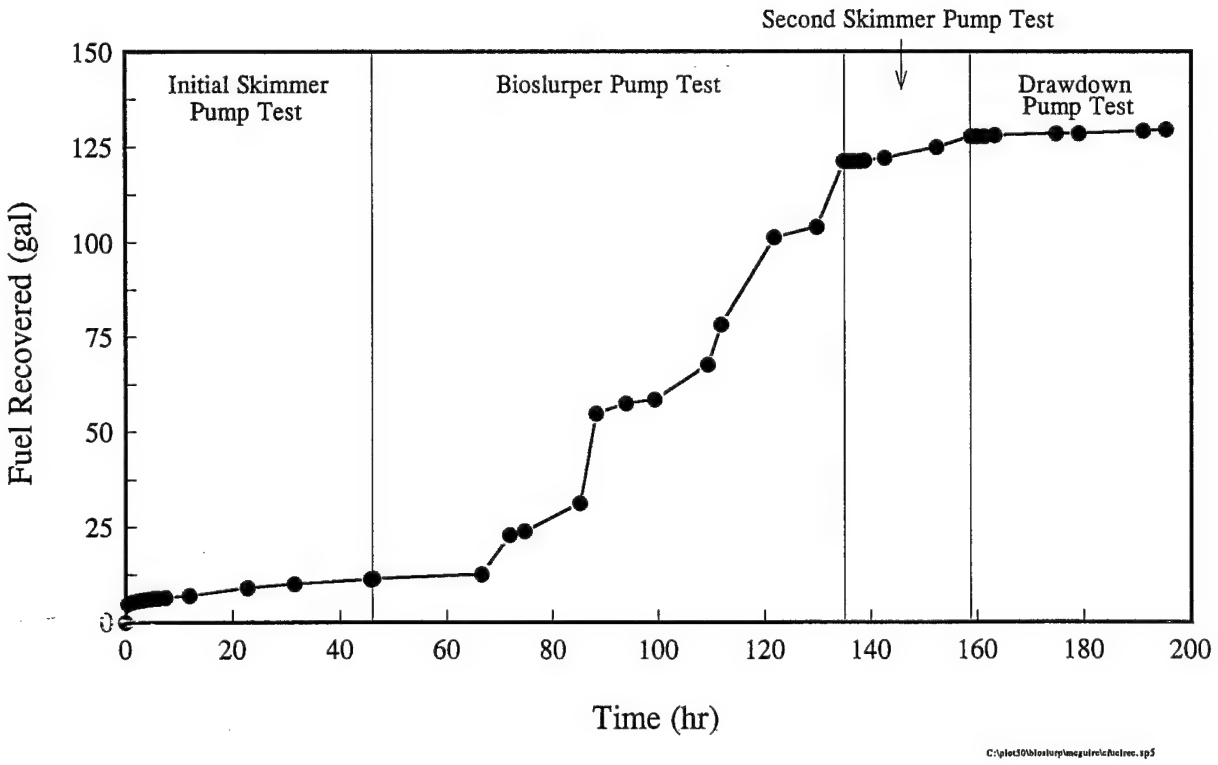

Figure 6. LNAPL Recovery Versus Time During Each Pump Test

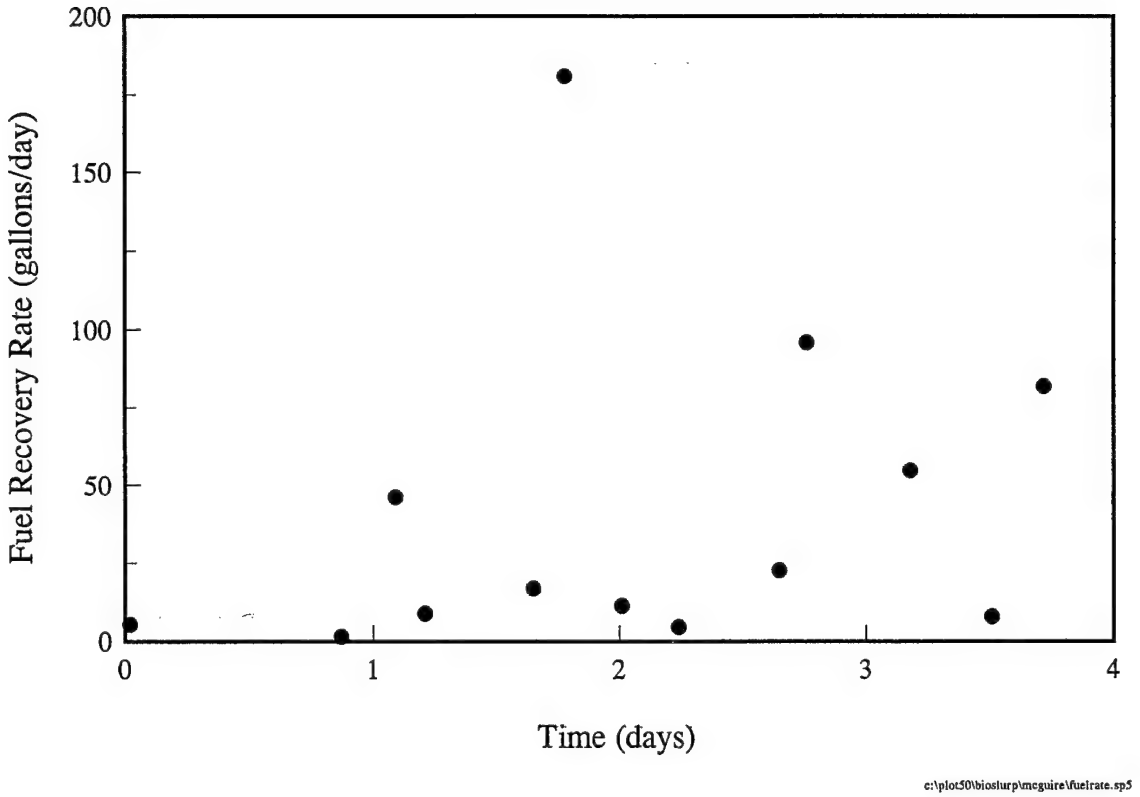

Figure 7. LNAPL Recovery Rate Versus Time During the Bioslurper Pump Test

Table 8. Oxygen Concentrations During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Point	Oxygen Concentrations (%) Versus Time (hours)			
	0	54	71	95
MPA-3.0′	4.8	9.5	NM	NM
MPA-6.0′	20.9	NM	NM	NM
MPB-3.0′	4.5	8.0	8.5	11
MPB-6.0′	NM	NM	NM	NM
MPB-9.0′	NM	15	NM	14
MPC-2.5′	19.0	17	12	11
MPC-6.0′	20.0	13	NM	NM
MPC-9.0′	18.0	8.5	5.5	6.0

NM = Not measured. Moisture content was too high to allow for collection of a soil gas sample.

4.3.3 Second Skimmer Pump Test

Totals of 6.6 gallons of LNAPL and 110 gallons of groundwater were recovered during the second skimmer pump test, with daily average recovery rates of 6.6 gallons/day for LNAPL and 110 gallons/day for groundwater (Table 7). These results demonstrate that operation of the bioslurper system in the skimmer mode was not as effective a means of free-product recovery as the bioslurper system at this site.

4.3.4 Drawdown Pump Test

Totals of 1.8 gallons of LNAPL and 1,100 gallons of groundwater were recovery during the drawdown pump test, with daily average recovery rates of 1.2 gallons/day for LNAPL and 730 gallons/day for groundwater (Table 7). These results demonstrate that operation of the bioslurper

system in the drawdown mode was not as effective a means of free-product recovery as the bioslurper system at this site.

4.4 Extracted Groundwater, LNAPL, and Off-Gas Analyses

Extracted groundwater samples were collected during the bioslurper pump test. BTEX concentrations were relatively high, with average BTEX concentrations of 20 mg/L, while TPH concentrations were relatively low with an average concentrations of 43 mg/L (Table 9).

Off-gas samples from the bioslurper system also were collected during the bioslurper pump test. The results from the off-gas analyses are presented in Table 10. Given a vapor flow of 60 scfm from the bioslurper well and a vapor concentration before ICE treatment of approximately 67,000 ppmv TPH and 220 ppmv benzene, emissions without ICE treatment would have been approximately 2,300 lb/day of TPH and 4.0 lb/day of benzene. With the ICE in place, at a vapor discharge rate of 120 scfm and using an average concentration of 1.3 ppmv TPH, approximately 0.087 lb/day of TPH was emitted to the air during the bioslurper pump test. Benzene emissions were below detection limits after treatment through the ICE. These results demonstrated the treatment efficiency of the ICE unit, with >99% destruction of BTEX and TPH.

The composition of LNAPL is shown in Tables 11 and 12 in terms of BTEX concentrations and distribution of C-range compounds, respectively. The distribution of C-range compounds is shown graphically in Figure 8.

4.5 Bioventing Analyses

4.5.1 Soil Gas Permeability and Radius of Influence

The bioslurper pilot test was conducted during a period of heavy rains. During the soil gas permeability test, the high moisture content in the soils caused erroneous pressure readings, probably due to water movement in the soil. Therefore, a radius of influence could not be calculated at this site.

Table 9. **BTEX and TPH Concentrations in Extracted Groundwater During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ**

Parameter	Concentration (mg/L)	
	MG-OWS-1	MG-DISCHARGE-1
TPH	47	38
Benzene	4.0	3.6
Toluene	9.4	8.6
Ethylbenzene	1.1	1.0
Total Xylenes	6.7	6.1

Table 10. **BTEX and TPH Concentrations in Off-Gas During the Bioslurper Pump Test at the Bulk Fuel Storage Area, McGuire AFB, NJ**

Parameter	Concentration (ppmv)					
	MG-LRP Reservoir-1	MG-LRP Reservoir-2	MG-LRP Stack-1	MG-LRP Stack-2	MG-ICE Stack-1	MG-ICE Stack-2
TPH as jet fuel	70,000	63,000	5.8	13	1.1	1.4
Benzene	47	390	0.021	0.044	<0.0040	<0.0020
Toluene	460	460	0.12	0.17	<0.0040	<0.0020
Ethylbenzene	25	27	0.011	0.017	<0.0040	<0.0020
Xylenes	78	86	0.053	0.056	<0.0040	<0.0020

Table 11. BTEX Concentrations in LNAPL from the Bulk Fuel Storage Area, McGuire AFB, NJ

Compound	Concentrations (mg/kg)
Benzene	1,600
Toluene	13,000
Ethylbenzene	2,900
Total Xylenes	18,000

Table 12. C-Range Compounds in LNAPL from the Bulk Fuel Storage Area, McGuire AFB, NJ

C-Range Compounds	Percentage of Total
< C7	26.4
C8	13.2
C9	10.8
C10	8.8
C11	9.5
C12	10.9
C13	10.0
C14	6.3
> C15	4.1

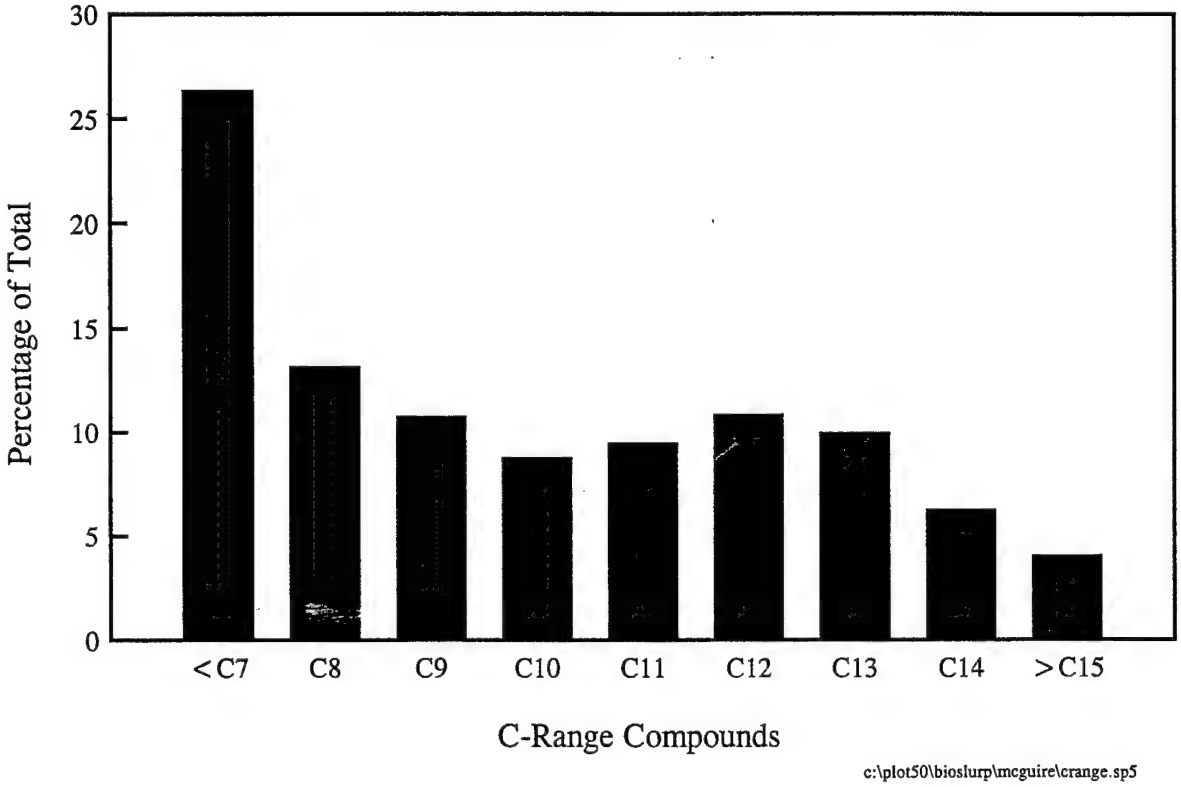

Figure 8. **Distribution of C-Range Compounds in Extracted LNAPL at the BFSA, McGuire AFB, NJ**

4.5.2 In Situ Respiration Test Results

Results from the in situ respiration test are presented in Table 13. Oxygen depletion was very rapid, with oxygen utilization rates ranging from 1.9 to 4.0% O_2/hr. Biodegradation rates ranged from 32 to 65 mg/kg-day. The helium concentration was steady, indicating that leakage and diffusion were insignificant.

Table 13. In Situ Respiration Test Results at the Bulk Fuel Storage Area, McGuire AFB, NJ

Monitoring Point	Oxygen Utilization Rate (%/hr)	Biodegradation Rate (mg/kg-day)
MPA-6.0′	4.0	65
MPB-9.0′	3.9	63
MPC-6.0′	1.9	32
MPC-9.0′	2.6	42

5.0 DISCUSSION

Skimmer and drawdown pumping were not as effective as bioslurping at recovering LNAPL from this site. Free product recovery rates decreased steadily during skimmer pumping, beginning at a rate of approximately 9.5 gallons/day during the initial skimmer pump test and decreasing to approximately 2.3 gallons/day by the end of the test. During drawdown pumping, LNAPL recovery rates averaged 1.2 gallons/day. In contrast, free product recovery rates during the bioslurper pump test remained relatively stable at an average of approximately 30 gallons/day.

Groundwater recovery rates during the bioslurper pump test were high in comparison to rates during the skimmer and drawdown pump tests. On average, groundwater was extracted at rates of 4,600 gallons/day during bioslurping, 92 gallons/day during skimming, and 730 gallons/day during drawdown pumping.

Soil gas concentrations were measured at monitoring points during the bioslurper pump test to determine whether the vadose zone was being oxygenated. In general, oxygen concentrations

increased at most monitoring points; however, due to the high soil moisture content, soil gas samples were difficult to collect and an adequate evaluation of the oxygen radius of influence could not be made. Because of the high soil moisture content, it was not possible to determine a pressure radius of influence.

Implementation of bioslurping at the McGuire AFB test site probably would facilitate enhanced recovery of LNAPL from the water table. However, bioslurping will result in a vapor stream requiring treatment and the extraction of significant quantities of groundwater. Given the treatment options of an ICE for vapors and discharge of extracted groundwater to the Industrial Wastewater Treatment Plant, bioslurping would be an economically viable alternative for this site.

6.0 REFERENCES

Battelle. 1995. *Test Plan and Technical Protocol for Bioslurping*, Report prepared by Battelle Columbus Operations for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

Hinchee, R.E., S.K. Ong, R.N. Miller, D.C. Downey, and R. Frandt. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Rev. 2), Report prepared by Battelle Columbus Operations, U.S. Air Force Center for Environmental Excellence, and Engineering Sciences, Inc. for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

APPENDIX A

SITE-SPECIFIC TEST PLAN FOR BIOSLURPER FIELD ACTIVITIES AT MCGUIRE AFB, NEW JERSEY

SITE-SPECIFIC TEST PLAN FOR BIOSLURPER TESTING AT THE BULK FUEL STORAGE AREA MCGUIRE AIR FORCE BASE, NEW JERSEY

FINAL

PREPARED FOR:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
(AFCEE/ERT)
8001 ARNOLD DRIVE
BROOKS AFB, TEXAS 78235-5357

AND

305 SPTG/CEV
MCGUIRE AFB, NEW JERSEY

30 OCTOBER 1995

SITE-SPECIFIC TEST PLAN FOR BIOSLURPER TESTING AT MCGUIRE AIR FORCE BASE, NEW JERSEY (A002) CONTRACT NO. F41624-94-C-8012

FINAL

to

Air Force Center for Environmental Excellence
Technology Transfer Division
(AFCEE/ERT)
8001 Arnold Drive
Building 642
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McGuire Air Force Base, New Jersey

October 30, 1995

by

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FINAL

to

Air Force Center for Environmental Excellence
Technology Transfer Division
(AFCEE/ERT)
Brooks AFB, Texas 78235

October 30, 1995

1.0 INTRODUCTION

The U.S. Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division is conducting a nationwide application of an innovative technology for free-product recovery and soil bioremediation. The technologies tested in the Bioslurper Initiative include vacuum-enhanced free-product recovery/bioremediation (bioslurping) as well as traditional skimmer and groundwater depression approaches. The field test and evaluation are intended to demonstrate the feasibility of free product recovery by measuring system performance in the field. System performance parameters, mainly free-product recovery, will be determined at numerous sites. Field testing will be performed at many sites to determine the effects of different organic contaminant types and concentrations and different geologic conditions on bioslurping effectiveness.

Plans for the field test activities are presented in two documents. The first is the overall Test Plan and Technical Protocol for the entire program entitled *Test Plan and Technical Protocol for Bioslurping* (Battelle, 1995). The overall plan is supplemented by plans specific to each test site. The concise site-specific plans effectively communicate planned site activities and operational parameters.

The overall Test Plan and Technical Protocol was developed as a generic plan for the Bioslurper Initiative to improve the accuracy and efficiency of site-specific Test Plan preparation. The field program involves installation and operation of the bioslurping system supported by a wide variety of site characterization, performance monitoring, and chemical analysis activities. The basic methods to be applied from site to site do not change. Preparation and review of the overall Test Plan and Technical Protocol allows efficient documentation and review of the basic approach to the test program. Peer and regulatory review were performed for the overall Test Plan and Technical Protocol to ensure the credibility of the overall program.

This report is the site-specific Test Plan for application of bioslurping at McGuire Air Force Base (AFB), New Jersey. It was prepared based on site-specific information received by Battelle from McGuire AFB and other pertinent site-specific information to support the overall Test Plan and Technical Protocol.

Site-specific information for McGuire AFB has identified subsurface hydrocarbon contamination at the Bulk Fuel Storage Area (BFSA). The contamination is generally associated with JP-4 jet fuel spills in the vicinity of the storage tanks. Free product, as light, non-aqueous phase liquid (LNAPL), has been measured north of Storage Tank 2115 at monitoring wells 08-MW-X12, 09-MW-X19, and 08-MW-X51. It is anticipated that the bioslurper demonstration will take place in the vicinity of these monitoring wells and if possible, one of these wells would be used to perform the extraction of JP-4 jet fuel.

2.0 SITE DESCRIPTION

The information presented in this section was obtained from the document titled, *Bulk Storage Area Feasibility Study, McGuire Air Force Base, New Jersey Volumes I and II, Internal Draft* prepared for HAZWRAP, Oak Ridge, Tennessee, Project No. 7610-02 by ABB Environmental Services Inc., October 1992.

McGuire AFB is located in the south-central portion of New Jersey (Figure 1). The installation is bordered by the Fort Dix Military Reservation to the east, south, and west, and by residential areas of the Town of Wrightstown (Burlington County), New Jersey to the north.

The BFSA is in the central portion of McGuire AFB and occupies approximately 24 acres (Figure 2). The facility consists of a series of eight aboveground storage tanks with capacities ranging from 500,000 to 850,000 gallons. Five of these tanks are dedicated to JP-4 jet fuel storage while the remaining tanks hold heating fuel for the central heating plant. All of the tanks are contained by an asphalt-covered earthen berm.

The BFSA has been in operation since 1963. During this time, fuel spills and storage/disposal activities have resulted in contamination at the site (Figure 3). In 1967, 500,000 gallons of JP-4 jet fuel were discharged from an open valve (location unknown, spill reportedly channelled to stream). In 1984, 500,000 gallons of JP-4 jet fuel were released from a ruptured underground pipeline northeast of Tank 2109. In 1987, 10,000 gallons of JP-4 jet fuel were spilled into the berm of Tank 2110. In 1988, an unspecified volume of heating oil was discharged north of Tanks 2120 and 2121. Finally, up until 1970, tank sludge was disposed of in the tank bermed areas, and fly ash and coal slag were stored and disposed north of the tank area.

In 1992, fuel was observed discharging from a subsurface organic silt layer into the unnamed tributary of South Run (Figure 3). The water in this unnamed tributary comes from shallow groundwater discharges, storm drain runoff, and cooling water discharge from the central heating plant.

Preliminary investigations of the site occurred in 1982, followed by site inspections in 1983 and 1988. During this time, monitoring wells were installed, groundwater samples were collected, and a pump test was performed. From 1990 to 1992, remedial investigations were performed to assess the extent of contamination.

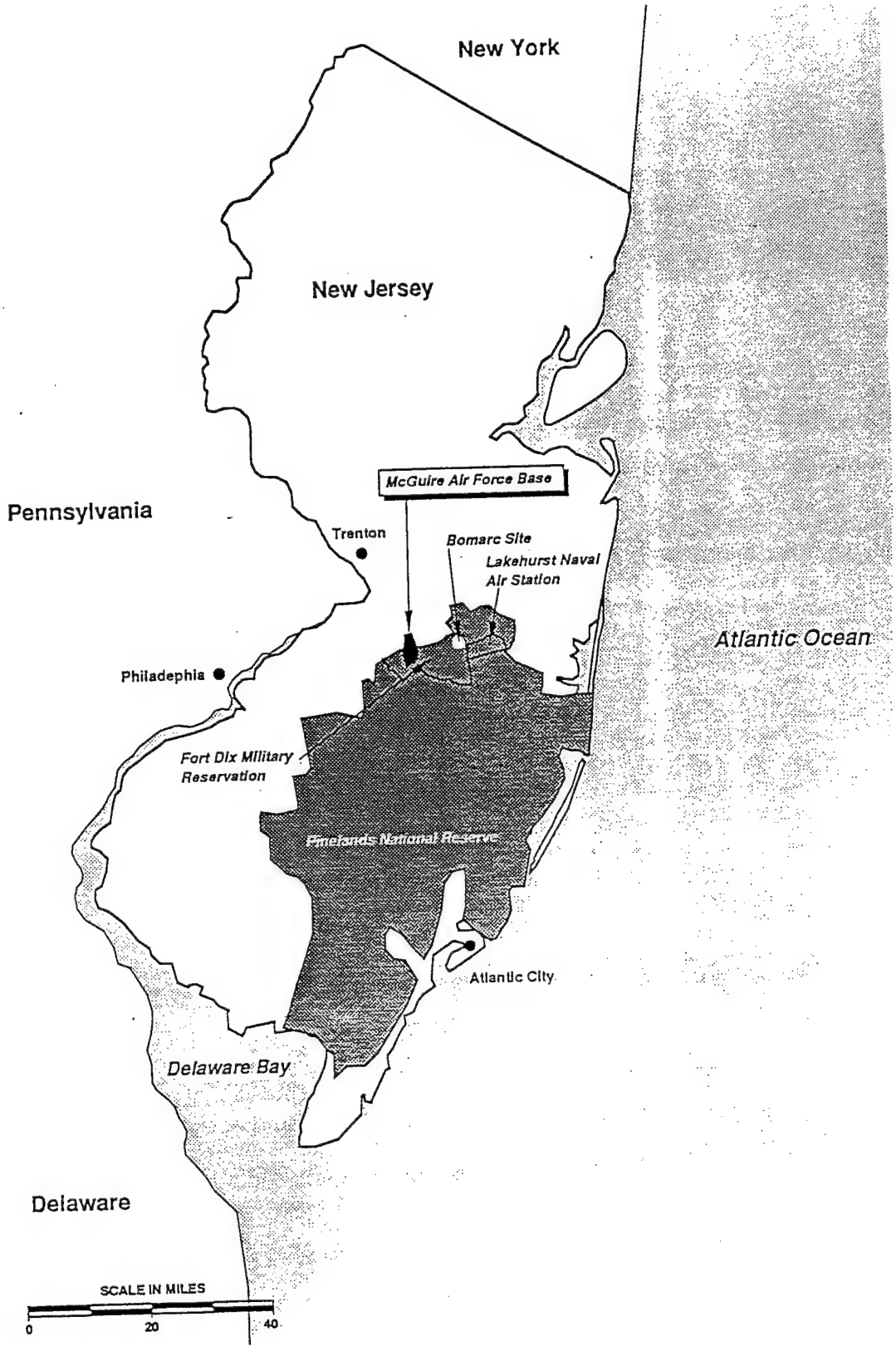

Figure 1. Map Showing Location of McGuire AFB, NJ

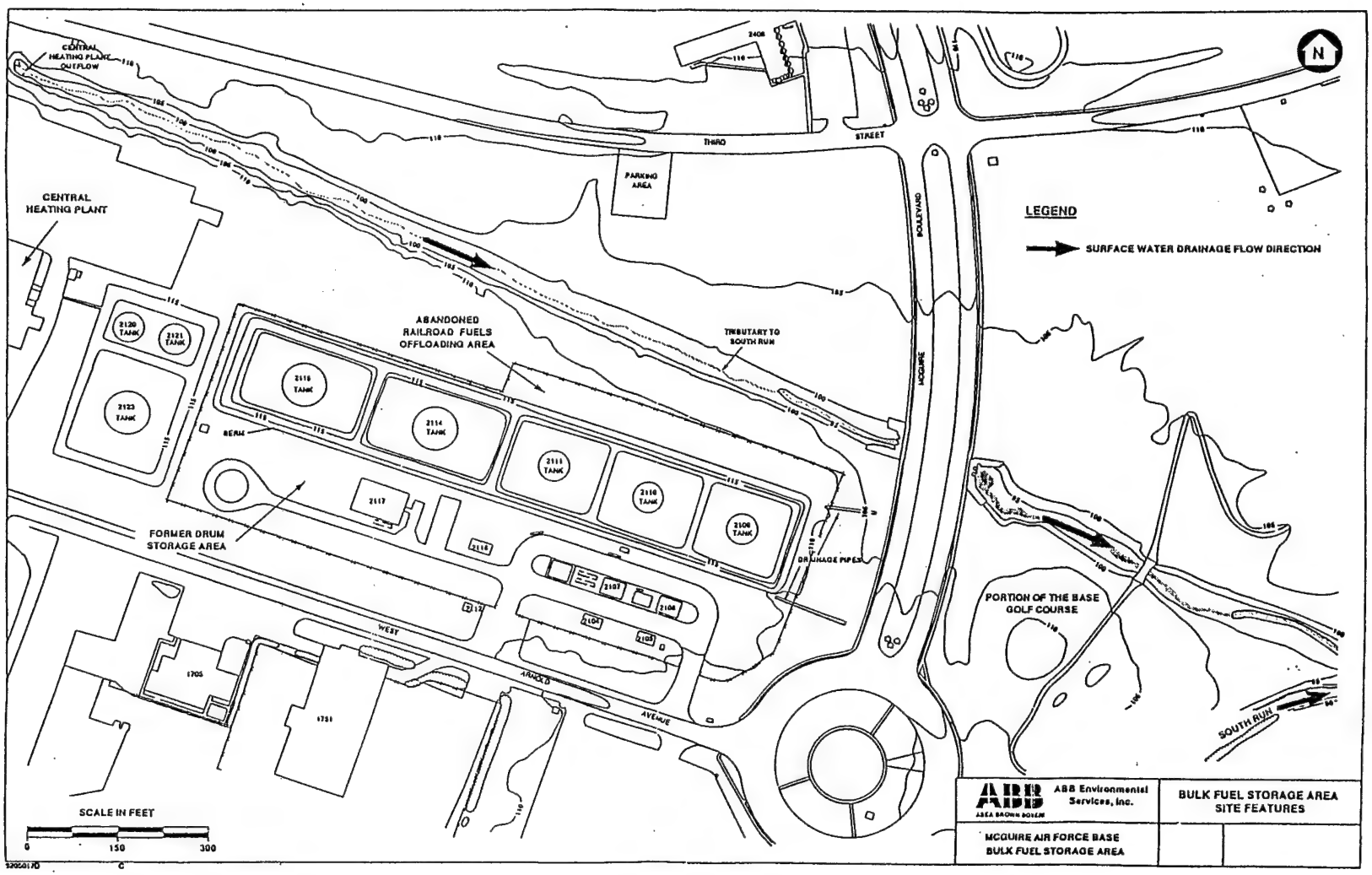

Figure 2. Schematic Diagram of the BFSA, McGuire AFB, NJ

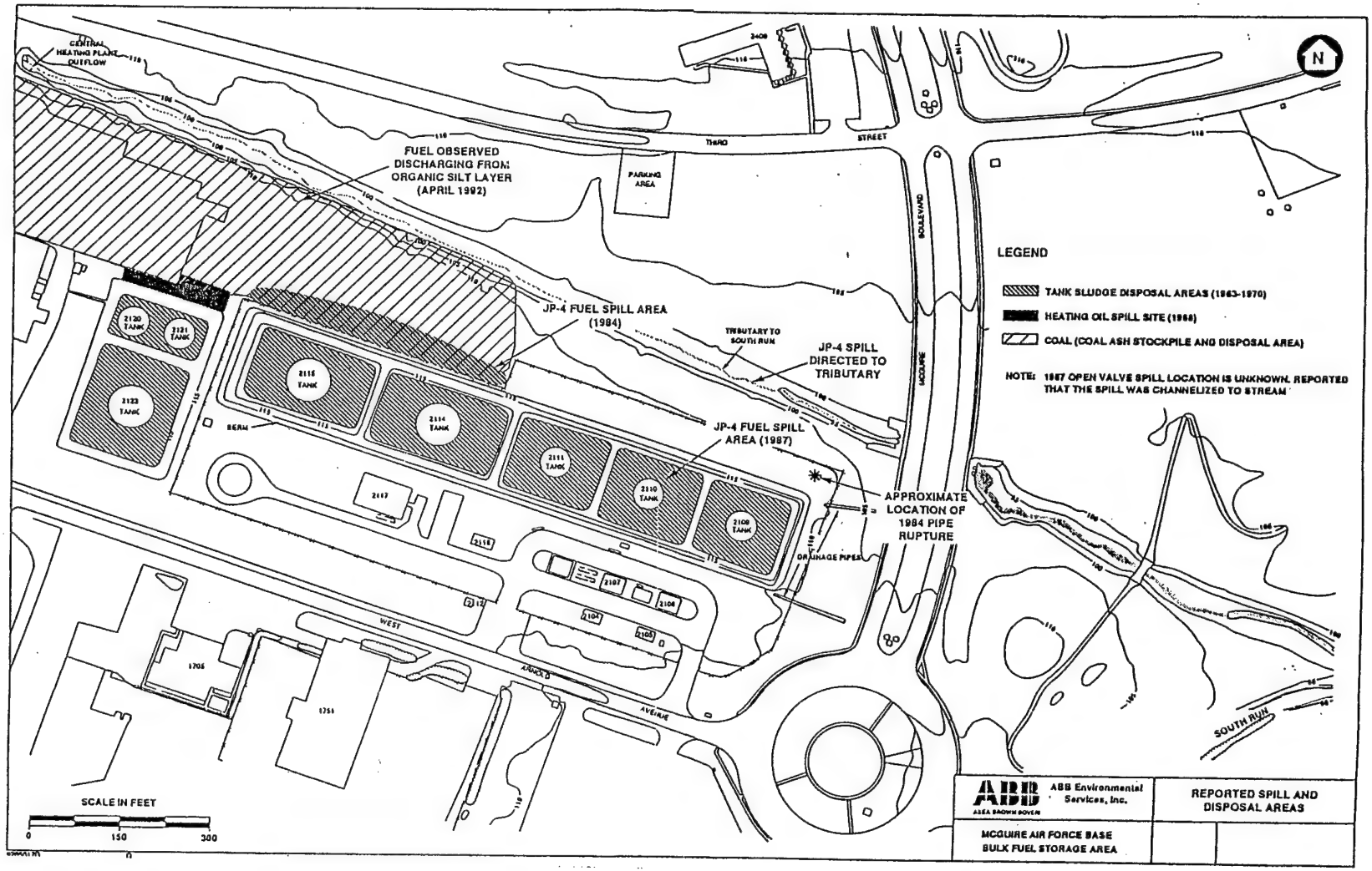

Figure 3. Schematic Diagram Showing Locations of Reported Spills and Disposal Areas at the BFSA, McGuire AFB, NJ

2.1 Site Geology

McGuire AFB rests on coastal plain sediments. The shallow stratigraphy consists primarily of interbedded continental and marine sands and silts. The thickness of these units vary, with each being up to 50 ft thick in the general area of McGuire AFB.

Site soils consist primarily of silty fine sands, interspersed with silt laminae and gravel seams. An organic silt layer with wood fragments and rootlets is present across the site between 11 and 14 ft below ground surface (bgs).

Geological profiles, geotechnical data (unit weight determinations and grain-size distributions), and piezometer and monitoring well installation logs from the BFSA are presented in Appendix A.

2.2 Aquifer Characteristics

Groundwater is part of the unconfined Cohansey/Kirkwood aquifer system and generally is found between 8 and 14 ft bgs across the site. This shallow aquifer is not used for consumptive purposes on the base. Groundwater elevation contours are shown in Figure 4.

The average hydraulic gradient across the site has been estimated at 0.006 ft/ft. The proximity of the tributary of South Run, which borders the site, results in gradients that are generally steeper closer to the tributary. Permeability testing has been performed utilizing the monitoring wells, and hydraulic conductivity values have been calculated using the Bouwer and Rice slug test solution. The average hydraulic conductivity was calculated at 2.3×10^{4} cm/sec. Using this data and assuming a porosity of 30%, the average seepage velocity was estimated to be 4.7 ft/year.

2.3 Site Contamination

Historical data indicate that at least 1.01 million gallons of JP-4 jet fuel have been discharged to the environment in the vicinity of the BFSA at McGuire AFB. Contamination also exists from a fuel oil spill of unknown volume and from the disposal and storage of tank sludge, fly ash slag, and coal.

Soil samples, both surface and subsurface, have been collected and analyzed for the presence of organic contamination. Benzene, toluene, ethylbenzene, and xylenes (BTEX) as well as semivolatile organic compounds (SVOCs) have been identified in a portion of the soil samples. Table 1 summarizes frequency of detection and reported concentrations of these compounds. Generally, the concentration levels or the frequency of occurrence indicated that the compounds identified did not exceed the New Jersey Department of Environmental Protection and Energy's (NJDEPE) proposed cleanup standards. The data do indicate that the contaminants are those typically associated with fuel spills and are therefore considered site related.

Soil gas samples collected in 1992 showed high BTEX and TPH concentrations, with average BTEX concentrations of 360 ppmv and average TPH concentrations of 54,000 ppmv.

Groundwater samples have been collected from locations upgradient and downgradient of the BFSA. The upgradient monitoring wells included: 08-MW-X20, 08-MW-X23, 08-MW-X24, 08-MW-101, and 08-MW-201 (Figure 4). A total of 20 downgradient wells were sampled to establish the extent of groundwater contamination. Monitoring wells that contained LNAPL were not sampled.

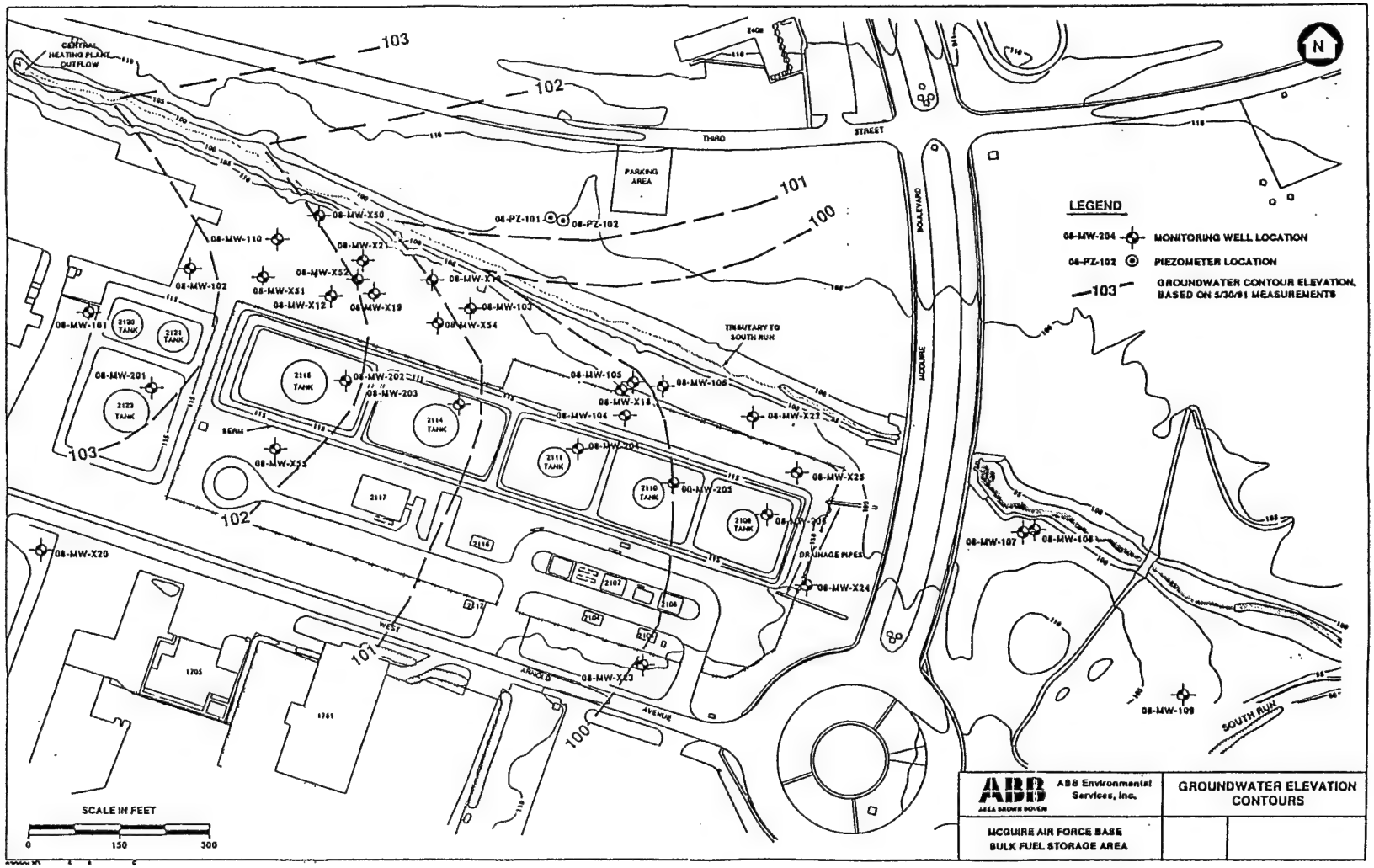

Figure 4. Schematic Diagram Showing Groundwater Elevation Contours at the BFSA, McGuire AFB, NJ

Table 1. **Concentrations of BTEX and Selected VOCs in Soil at the BFSA, McGuire AFB, NJ**

Compound	Frequency	Average Background Concentration (μg/kg)	Average BFSA Concentration (μg/kg)
Surface Soil Analyses			
Benzene	9/48	110	360
Toluene	12/48	4.2	1,300
Ethylbenzene	15/48	16	900
Total Xylenes	17/48	90	3,600
Naphthalene	12/48	68	490
2-Methylnaphthalene	3/12	220	2,400
Subsurface Soil Analyses			
Benzene	64/325	14	360
Toluene	65/322	4.2	1,300
Ethylbenzene	84/211	16	900
Total Xylenes	93/322	90	3,600
Naphthalene	48/298	68	490
2-Methylnaphthalene	9/32	220	2,400

Table 2. Concentrations of BTEX and Selected VOCs in Groundwater at the BFSA, McGuire AFB, NJ

Compound	Upgradient Frequency	Downgradient Frequency	Mean Upgradient Concentration (μg/L)	Mean Downgradient Concentration (μg/L)
Benzene	0/3	10/19	37	510
Toluene	0/3	7/19	37	1,400
Ethylbenzene	0/3	9/19	37	2,200
Total Xylenes	0/3	10/19	37	1,100
Phenol	0/3	7/19	23	21
2-Methylphenol	0/3	5/20	23	18
3-Methylphenol	0/3	7/20	23	54
2,3-Dimethylphenol	0/3	2/20	23	18
Naphthalene	0/3	10/20	23	34
2-Methylnaphthalene	0/3	2/20	23	14
bis(2-ethylhexyl)phthalate	0/3	2/19	410	14

Table 3. Free Product Thicknesses at the BFSA, McGuire AFB, NJ

Monitoring Well	Free Product Thickness (ft)	
	5/30/91	6/22/94
08-MW-X12	4.44	4.69
08-MW-X18	2.46	2.85
08-MW-X19	6.71	5.37
08-MW-X21	3.01	2.46
08-MW-X51	1.61	3.27
08-MW-X54	0.12	0.04

Groundwater summary data for BTEX and SVOCs are presented in Table 2. Given these data, it appears that contamination of the groundwater is due to the fuel releases at the BFSA and affects the groundwater downgradient of the site (Figure 5).

LNAPL measurements have been made at the monitoring points at the BFSA. Product thickness measurements are presented in Table 3. The distribution of LNAPL indicates that the thickest subsurface layer of organic contamination resides north of Tank 2115. It is in this location that the demonstration of the bioslurper technology is expected to take place. One of the existing monitoring wells (08-MW-X12, 08-MW-X19, or 08-MW-X51) is expected to be used for the LNAPL extraction.

The soil, groundwater, and LNAPL characterization of the site around the BFSA has allowed for an estimate of the free product presently existing within the lateral extent of the plume. A total volume of 250,000 to 750,000 gallons of LNAPL is estimated to be present in the subsurface formation below and downgradient of the BFSA. A portion of this volume will be affected during the bioslurper demonstration at the BFSA, McGuire AFB.

3.0 PROJECT ACTIVITIES

The field activities discussed in the following sections are planned for the bioslurper pilot test at McGuire AFB. Additional details about the activities are presented in the overall Test Plan and Technical Protocol. As appropriate, specific sections in the overall Test Plan and Technical Protocol are referenced. Table 4 presents the schedule of activities for the Bioslurper Initiative at McGuire AFB.

3.1 Mobilization to the Site

After the site-specific Test Plan is approved, Battelle staff will mobilize equipment to the site. Some of the equipment will be shipped via air express to McGuire AFB prior to staff arrival. The Base Point-of-Contact (POC) will have been asked in advance to find a suitable holding facility to receive the bioslurper pilot test equipment so that it will be easily accessible to the Battelle staff when they arrive with the remainder of the equipment. The exact mobilization date will be confirmed with the Base POC as far in advance of fieldwork as is possible. The Battelle POC will provide the Base POC with information on each Battelle employee who will be on site. Battelle personnel will be mobilized to the site after confirmation that the shipped equipment has been received by McGuire AFB.

3.2 Site Characterization Tests

3.2.1 Baildown Tests

The baildown test is the primary test for selection of the bioslurper test well. Baildown tests are also useful for the evaluation of actual versus apparent free product thicknesses. Baildown tests will be performed at wells that contain measurable thicknesses of LNAPL to estimate the LNAPL recovery potential at those particular wells. Baildown tests are planned at monitoring wells 08-MW-X12, 08-MW-X19, and 08-MW-X51. In most cases, the well exhibiting the highest rate of LNAPL recovery will be selected for the bioslurper extraction well. A sample of free LNAPL will be collected at this point for analyses of boiling point distribution and BTEX concentration. Detailed procedures for the baildown tests are provided in Section 5.6 of the overall Test Plan and Technical Protocol.

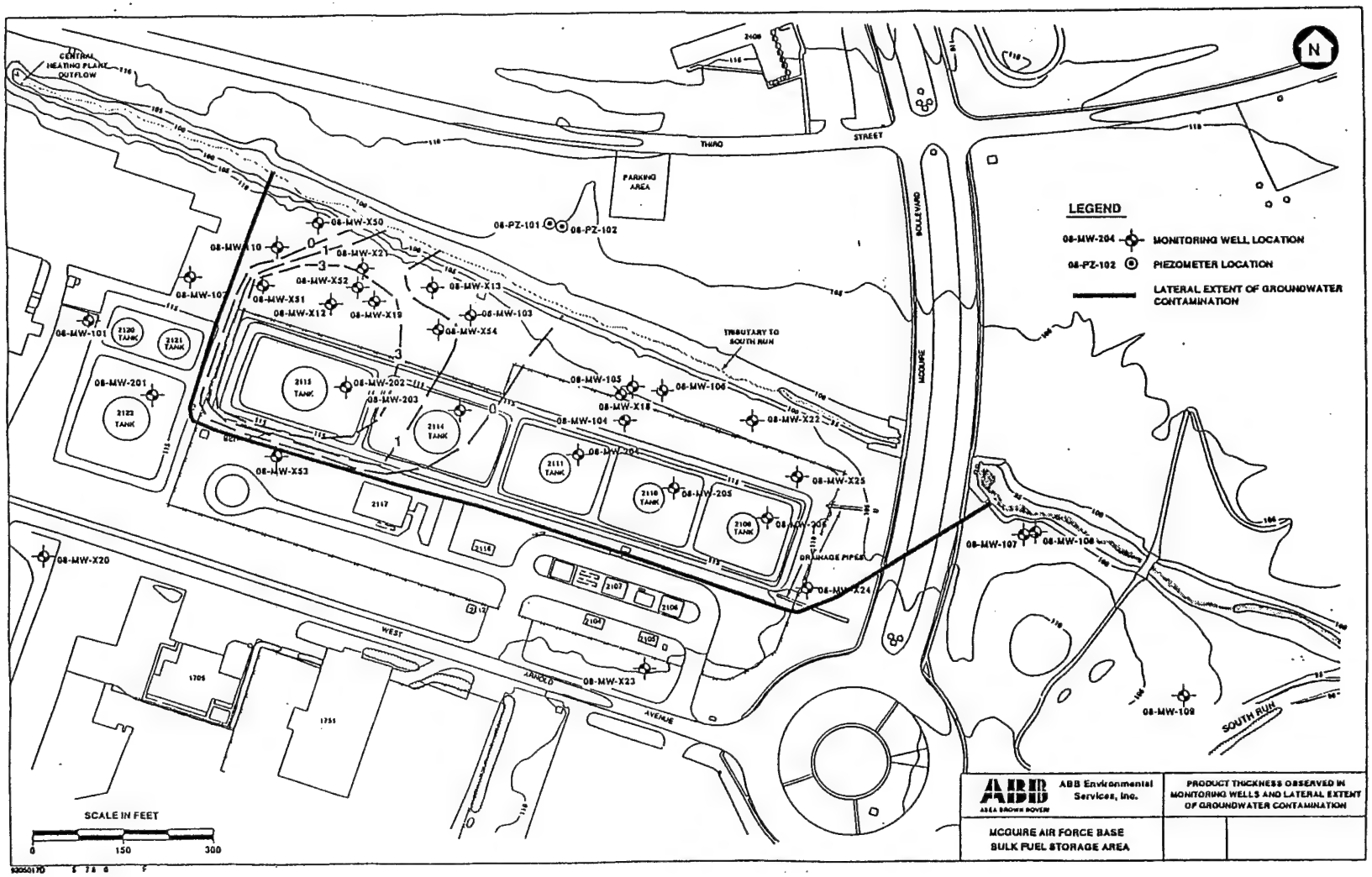

Figure 5. Schematic Diagram of the Lateral Extent of Groundwater Contamination and Product Thickness at the BFSA, McGuire AFB, NJ

Table 4. Schedule of Bioslurper Pilot Test Activities

Pilot Test Activity	Schedule
Mobilization	Day 1-2
Site Characterization	Day 2-3
LNAPL/Groundwater Interface Monitoring and Baildown Tests	
Soil Gas Survey (Limited)	
Monitoring Point Installation (3 monitoring points)	
Soil Sampling (BTEX, TPH, physical characteristics)	
System Installation	Day 2-3
Test Startup	Day 3
Skimmer Pump Test (2 days)	Day 3-4
Bioslurper Pump Test (4 days)	Day 6-9
Soil Gas Permeability Testing	Day 6
Skimmer Pump Test (continued)	Day 10
In Situ Respiration Test - Air/Helium Injection	Day 10
In Situ Respiration Test - Monitoring	Day 11-16
Drawdown Pump Test (2 days)	Day 11-12
Demobilization/Mobilization	Day 13-14

3.2.2 Soil Gas Survey (Limited)

A small-scale soil gas survey will be conducted to identify the best location for installation of the bioslurping system. The soil gas survey will be conducted in areas where historical site data indicated the highest contamination levels. These areas will be surveyed to select the locations for installation of soil gas monitoring points. Monitoring points will be located in areas that exhibit the following soil gas characteristics.

1. Relatively high TPH concentrations (10,000 ppmv or greater).

2. Relatively low oxygen concentrations (between 0% and 2%).

3. Relatively high carbon dioxide concentrations (depending on soil type, between 2% and 10% or greater).

Additional information on the soil gas survey is provided in Section 5.2 of the overall Test Plan and Technical Protocol.

3.2.3 Monitoring Point Installation

Monitoring points must be installed to determine the radius of influence of the bioslurper system in the vadose zone. A general arrangement of the bioslurping well and monitoring points is shown in Figure 6.

Upon completion of the initial soil gas survey and baildown tests, at least three soil gas monitoring points will be installed (unless existing monitoring points are available for use) to measure soil gas changes that occur during bioslurper operation. These monitoring points should be located in highly contaminated soils within the free-phase plume and should be positioned to allow detailed monitoring of the in situ changes in soil gas composition caused by the bioslurper system. Three monitoring points were previously installed at the site and are located southeast of monitoring well 08-MW-X12. These points will be used if they are located close enough to the selected bioslurper well to allow for proper testing. A schematic diagram of a typical monitoring point is shown in Figure 7. Information on monitoring point installation can be found in Section 4.2.1 of the overall Test Plan and Technical Protocol.

3.2.4 Soil Sampling

Soil samples will be collected from each boring to determine the physical and chemical composition o the soil near the bioslurper test site. Soil samples will be collected from the boreholes advanced for monitoring point installation at two or three locations at the site chosen for the bioslurper test. Generally, samples will be collected from the capillary fringe over the free product.

Soil samples from each boring will be analyzed for BTEX, bulk density, moisture content, particle size distribution, porosity, and TPH. Section 5.5.1 of the overall Test Plan and Technical Protocol contains additional information on field measurements and sample collection procedures for soil sampling.

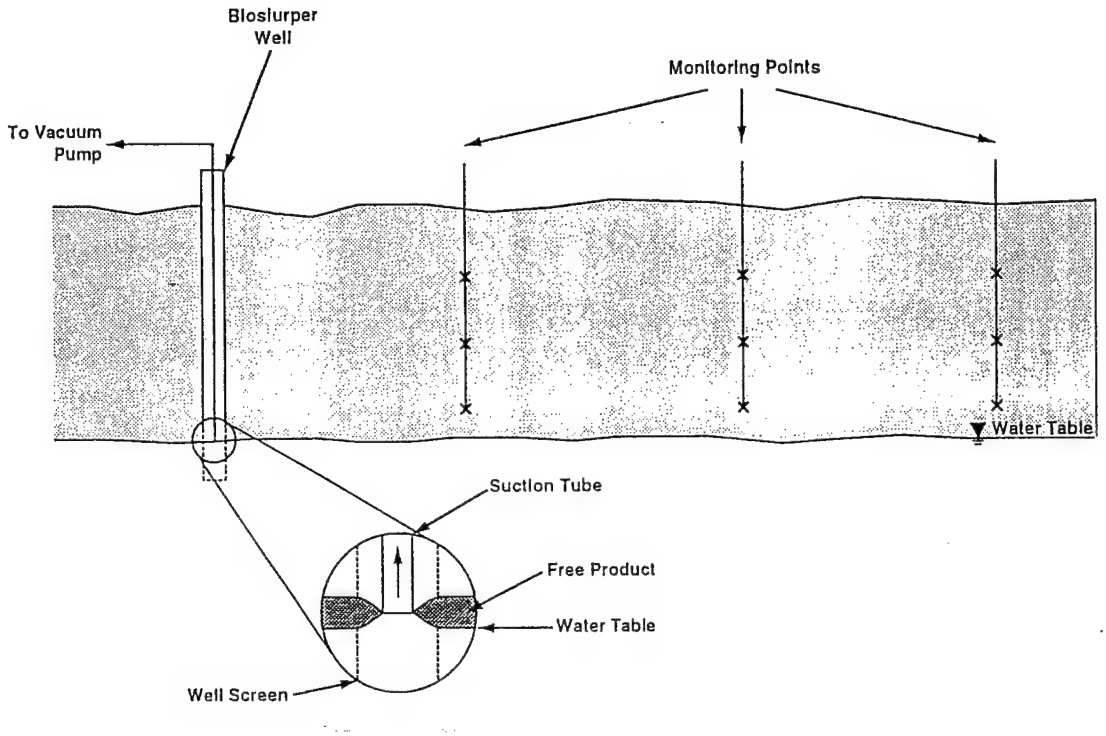

Figure 6. General Bioslurper Well and Monitoring Point Arrangement

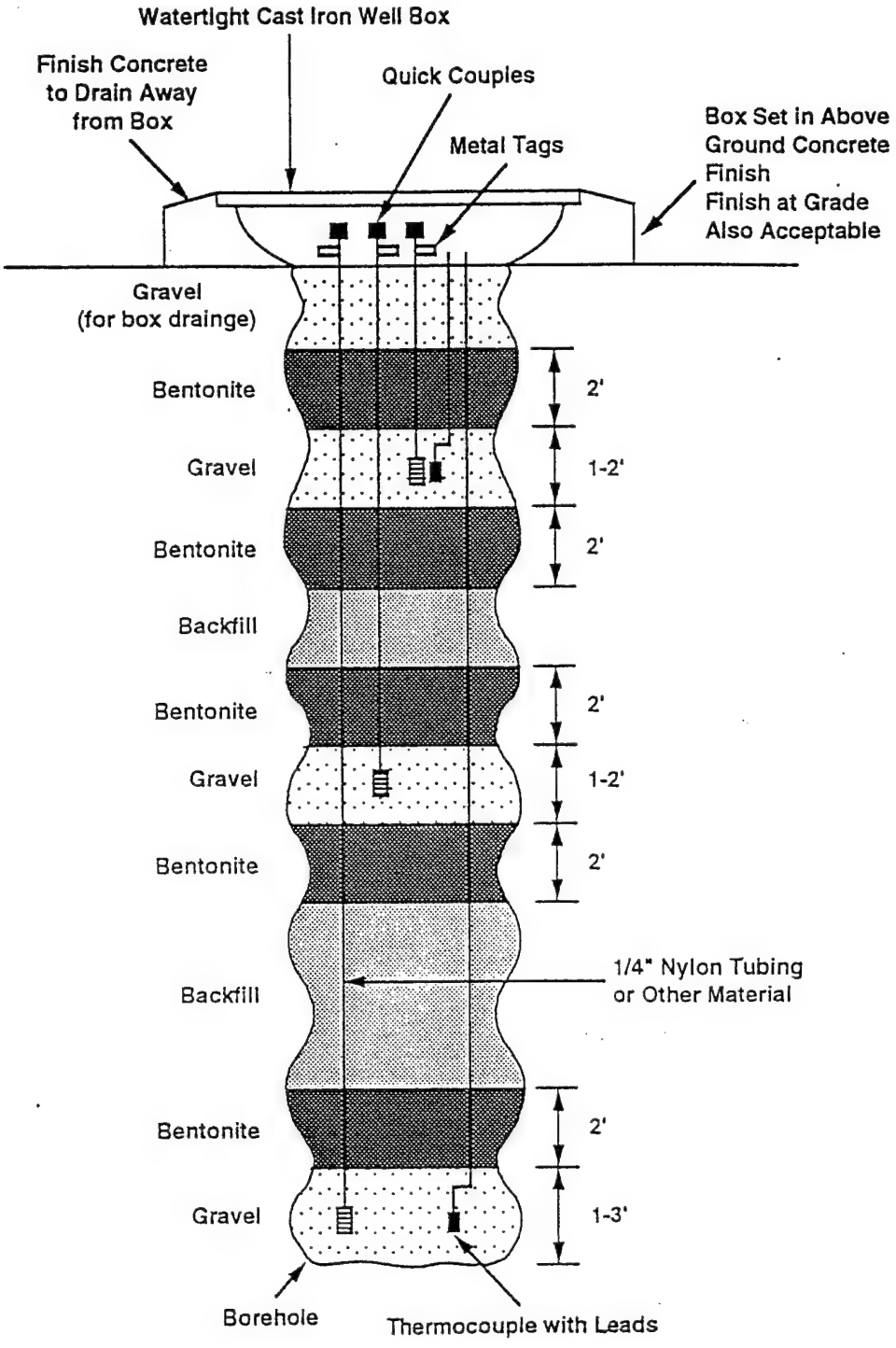

Figure 7. Schematic Diagram of a Typical Monitoring Point

3.3 Bioslurper System Installation and Operation

Once the well to be used for the bioslurper test installation at McGuire AFB has been identified, the bioslurper pump and support equipment will be installed and pilot testing will be initiated.

3.3.1 System Setup

After the preliminary site characterization has been completed and the bioslurper candidate well has been selected, the shipped equipment will be mobilized from the holding facility to the test site, and the bioslurper system will be assembled. Figure 8 shows a flow diagram of the bioslurper process. Figure 9 illustrates a typical bioslurper well that will be used at McGuire AFB.

Before the LNAPL recovery tests are initiated, all relevant baseline field data will be collected and recorded. These data will include soil gas concentrations, initial soil gas pressures, the depth to groundwater, and the LNAPL thickness. Ambient soil and all atmospheric conditions (e.g., temperature, barometric pressure) also will be recorded. All emergency equipment (i.e., emergency shutoff switches and fire extinguishers) will be installed and checked for proper operation at this time.

A clear, level 20- by 10-ft area near the well selected for the bioslurper test installation will be identified to station the equipment required for bioslurper system operation. Additional information on bioslurper system installation is provided in Section 6.0 of the overall Test Plan and Technical Protocol.

3.3.2 System Shakedown

A brief startup test will be conducted to ensure that the system is constructed properly and operates safely. All system components will be checked for problems and/or malfunctions. A checklist will be provided to document the system shakedown.

3.3.3 System Startup and Test Operations

After installation is complete and the bioslurper system is confirmed to be operating properly, the LNAPL recovery tests will be started. The Bioslurper Initiative has been designed to evaluate the effectiveness of bioslurping as an LNAPL recovery test technology relative to conventional gravity-driven LNAPL recovery technologies. The Bioslurper Initiative includes three separate LNAPL recovery tests: (1) a skimmer pump test, (2) a bioslurper pump test, and (3) a drawdown pump test. The three recovery tests are described in detail in Section 7.3 of the overall Test Plan and Technical Protocol.

The bioslurper system operating parameters that will be measured during operation are vapor discharge, aqueous effluent, LNAPL recovery volume rates, vapor discharge volume rates, and groundwater discharge volume rates. Vapor monitoring will consist of periodic monitoring of TPH using hand-held instruments supplemented by two samples collected for detailed laboratory analysis. Two samples of aqueous effluent will be collected for analysis of BTEX and TPH. Recovered LNAPL volume will be recorded using an in-line flow-totalizing meter. The off-gas discharge volume will be measured using a calibrated pitot tube, and the groundwater discharge volume will be recorded using an in-line flow-totalizing meter. Section 8.0 of the overall Test Plan and Technical Protocol describes process monitoring of the bioslurper system.

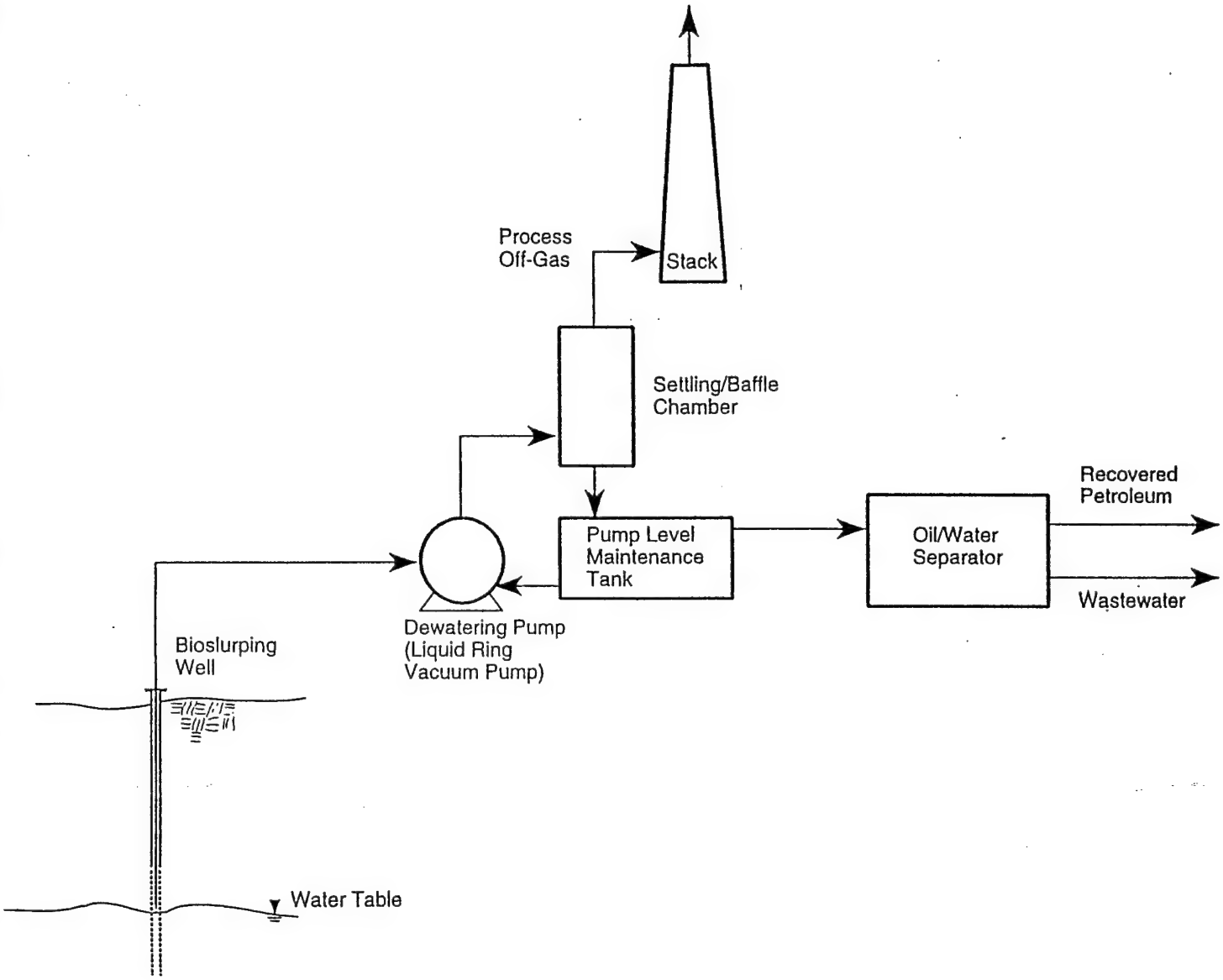

Figure 8. Bioslurper Process Flow at the BFSA, McGuire AFB, NJ

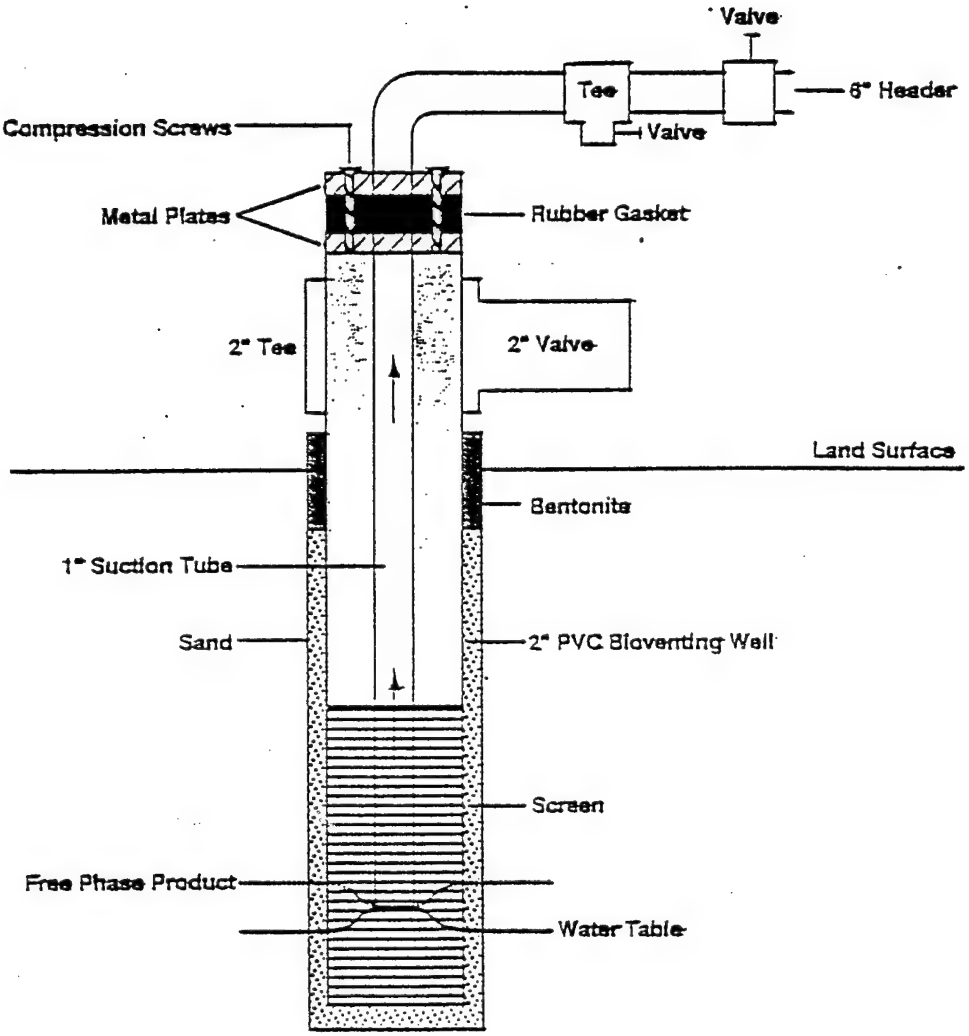

Figure 9. Schematic Diagram of a Typical Bioslurper Well

3.3.4 Soil Gas Profile/Oxygen Radius of Influence Test

Changes in soil gas profiles will be measured before and during the bioslurper pump test. Soil gas will be monitored for concentrations of oxygen, carbon dioxide, and TPH using field instruments. These measurements will be used to determine the oxygen radius of influence of the bioslurper.

3.3.5 Soil Gas Permeability Tests

A soil gas permeability test will be conducted concurrently with startup of the bioslurper pump test. Soil gas permeability data will support the process of estimating the vadose zone radius of influence of the bioslurper system. Soil gas permeability results also will aid in determining the number of wells required if it is decided to treat the site with a full-scale bioslurper system. The soil gas permeability test method is described in Section 5.7 of the overall Test Plan and Technical Protocol.

3.3.6 LNAPL and Groundwater Level Monitoring

During the bioslurper pump test, the LNAPL and groundwater levels will be monitored in a well adjacent to the extraction well if such a well exists. The top of the monitoring well will be sealed from the atmosphere so the subsurface vacuum will be contained. Additional information for the monitoring of fluid levels is provided in Section 4.3.4 of the overall Test Plan and Technical Protocol.

3.3.7 In Situ Respiration Test

An in situ respiration test will be conducted after completion of the bioslurper pilot tests. The in situ respiration test will involve injection of air and helium into selected soil gas monitoring points followed by monitoring changes in concentrations of oxygen, carbon dioxide, TPH, and helium in soil gas at the injection point. Measurement of the soil gas composition typically will be conducted at 2, 4, 6, and 8 hours and then every 4 to 12 hours for about 2 days. Timing of the tests will be adjusted based on the oxygen-use rate. If oxygen depletion occurs rapidly, more frequent monitoring will be required. If oxygen depletion is slow, less frequent readings will be acceptable. The oxygen utilization rate will be used to estimate the biodegradation rate at the site. Further information on the procedures and data collection of the in situ respiration test is provided in Section 5.8 of the overall Test Plan and Technical Protocol.

3.3.8 Extended Testing

The Air Force has the option of extending the operation of the bioslurper system for up to six months if LNAPL recovery rates are promising and long-term vapor and aqueous discharge requirement have been established. If extended testing is to be performed, the Air Force will need to provide electrical power for long-term operation of the bioslurper pump. Disposition of all generated wastes and routine operation and maintenance of the system will be the Air Force's responsibility. Battelle will provide technical support during the extended testing operation.

3.4 Demobilization

Once all necessary tests have been completed at the McGuire AFB site, the equipment will be disassembled by Battelle staff. The equipment then will be moved back to the holding facility, where it will remain until its next destination is determined. Battelle staff will receive this information and will be responsible for shipment of the equipment to the next site before they leave McGuire AFB.

4.0 BIOSLURPER SYSTEM DISCHARGE

4.1 Vapor Discharge Disposition

Battelle expects that the operation of the bioslurper test system at McGuire AFB will require a waiver or a point source air release registration and may require some additional permits. However, because of the short duration of the bioslurper pilot test, it can be assumed that the concentrations of TPH released to the atmosphere will be approximately 46 lb/day and benzene will be <0.1 lb/day without treatment. This value is based on the average discharge rates at three bioslurper test sites (Johnston Atoll, Travis AFB, and Wright-Patterson AFB) that are contaminated with a similar type of fuel as that found at the BFSA. The discharge value may vary depending on concentrations in soil gas and the permeability of the soil. The data for benzene and TPH discharge levels for 6 previous bioslurper sites are presented in Table 5. The relatively large TPH discharge level at Travis AFB is partially due to the extraction rate. This extraction rate is the maximum rate a 3-hp pump can achieve and may be lower at McGuire AFB due to the permeability of the soil. The vapor stream generated by the bioslurper system can be discharged directly to the atmosphere because of the short duration of the test and the low concentrations of benzene and TPH. A short-term (5 to 6-day pumping) waiver to operated as specified above is requested (the air permit is provided in Appendix B).

To ensure the safety and regulatory compliance of the bioslurper system, field soil gas screening instruments will be used to monitor vapor discharge concentration. The volume of vapor discharge will be monitored daily using air flow instruments. If state regulatory requirements will not permit the expected amount of organic vapor discharge to the atmosphere, the Base POC should inform AFCEE and Battelle so that alternative plans can be made prior to mobilization to the site. Table 6 presents information typically required to complete an air release registration form.

4.2 Aqueous Influent/Effluent Disposition

The flowrate of groundwater pumped by the bioslurper will be less than 5 gpm. However, it may be necessary in New Jersey to obtain a groundwater pumping waiver or registration permit. If one is required, the Base POC will inform Battelle of the necessary steps in obtaining the waiver or permit.

Operation of the bioslurper system will generate an aqueous waste discharge that will be passed through a bag filter, an oil/water separator, hydrophobic clay drums, and activated carbon drums (Figure 7). Table 7 provides effluent data for sites where groundwater has been treated in this manner. Sites not listed did not receive any treatment other than an oil/water separator. The intention of Battelle staff will be to dispose of the treated wastewater by discharge directly to the Fort Dix Sewage Treatment Plant.

Table 5. Benzene and TPH Vapor Discharge Levels at Previous Bioslurper Test Sites

Site Location	Fuel Type	Extraction Rate (scfm)	Benzene (ppmv)	TPH (ppmv)	Benzene Discharge (lb/day)	TPH Discharge (lb/day)
Andrews AFB	No. 2 Fuel Oil	8.0	16	2,000	0.0010	0.20
Site 1, Bolling AFB	No. 2 Fuel Oil	4.0	0.20	153	0.00030	0.0090
Site 2, Bolling AFB	Gasoline	21	370	70,000	2.3	470
Johnston Atoll	Jet Fuel	10	0.60	975	0.0017	5.7
Travis AFB	Jet Fuel	20	100	10,800	0.58	130
Wright-Patterson AFB	Jet Fuel	3.0	ND	595	0	1.0

ND = Not detected.

Table 6. Air Release Summary Information

Data Item	Air Release Information
Contractor Point-of-Contact	Jeff Kittel, (614) 424-6122
Contractor address	Battelle, 505 King Avenue, Columbus, OH 43201
Estimated total quantity of petroleum product to be recovered	To be determined
Description of petroleum product to be recovered	JP-4 jet fuel
Planned date of test start	To be determined
Test duration	9-10 days (active pumping)
Maximum expected volatile organic compound level in air	~46 lb/day TPH, <0.1 lb/day benzene
Stack height above ground level	10 ft

Table 7. Effluent Groundwater Concentrations of Benzene and TPH After Treatment at Previous Bioslurper Test Sites[1]

Site Location	Fuel Type	Benzene (mg/L)	TPH (mg/L)
Andrews AFB	No. 2 Fuel Oil	0.096	270
Travis AFB	Jet Fuel	1.0	17

1 Groundwater effluent at Bolling AFB, Johnston Atoll, and Wright-Patterson AFB were discharged with less treatment, and are therefore not presented in this table.

4.3 Free-Product Recovery Disposition

The bioslurper system will recover free-phase product from the pilot tests performed at McGuire AFB. Recovered free product will be turned over to the Base for disposal and/or recycling. The volume of free product recovered from the Base will not be known until the tests have been performed. The maximum recovery rate for this system is 5 gpm, but the actual rate of LNAPL recovery likely will be much lower.

5.0 SCHEDULE

The schedule for the bioslurper fieldwork at McGuire AFB will depend on approval of the project Test Plan. Battelle will determine a definitive schedule as soon as possible after approval is received. Battelle will have two to three staff members on site for approximately 2 weeks to conduct all necessary pilot testing. At the conclusion of the field testing at McGuire AFB, all staff will return their Base passes. Battelle staff will remove all bioslurper field testing equipment from the Base before they leave the site.

6.0 PROJECT SUPPORT ROLES

This section outlines some of the major functions of personnel from Battelle, McGuire AFB, and AFCEE during the bioslurper field test.

6.1 Battelle Activities

The obligations of Battelle in the Bioslurper Initiative at McGuire AFB will be to supply the staff and equipment necessary to perform all the tests on the bioslurper system. Battelle also will provide technical support in the areas of water and vapor discharge permitting, digging permits, staff support during the extended testing period, and any other technical areas that need to be addressed.

6.2 McGuire AFB Support Activities

To support the necessary field tests at McGuire AFB, the Base must be able to provide the following:

a. Any digging permits and utility clearances that need to be obtained prior to the initiation of the fieldwork. Any underground utilities should be clearly marked to reduce the chance of utility damage and/or personal injury during soil gas probe and possible well installation. Battelle will not begin field operations without these clearances and permits.

b. The Air Force will be responsible for obtaining Base and site clearance for the Battelle staff that will be working at the Base. The Base POC will be furnished with all necessary information on each staff member at least one week prior to field startup.

c. Access to the local sanitary sewer must be furnished so that Battelle staff can discharge the bioslurper aqueous effluent directly to the Fort Dix Sewage Treatment Plant.

d. Regulatory approval, if required, must be obtained by the Base POC prior to startup of the bioslurper pilot test. As stated previously, it is likely that a waiver or permit to allow air releases or a point source air release registration will be required for emissions of approximately 46 lb/day of TPH and <0.1 lb/day benzene without treatment (the air permit is provided in Appendix B). A waiver for pumping and discharging groundwater at a rate of 5 gpm may be required. The Base POC will obtain all necessary Base permits prior to mobilization to the site. Battelle will provide technical assistance in preparing regulatory approval documents.

e. The Base also will be responsible for the disposition of all waste generated from the pilot testing. Such waste includes any soil cuttings generated from drilling, and all aqueous wastestreams produced from the bioslurper tests. All free product recovered from the bioslurper operation will be disposed of or recycled by the Base. Battelle will provide technical assistance in disposing of the waste generated from the bioslurper pilot test.

f. Before field activities begin, the Health and Safety Plan will be finalized with information provided by the Base POC. Table 8 is a checklist for the information required to complete the Health and Safety Plan. All emergency information will be obtained by the Site Health and Safety office before operations begin.

6.3 AFCEE Activities

The AFCEE POC will act as a liaison between Battelle and McGuire AFB staff. The AFCEE POC will ensure that all necessary permits are obtained and the space required to house the bioslurper field equipment is found.

Table 8. Health and Safety Information Checklist

Emergency Contacts	Name	Telephone Number
Burlington County Hospital		(609) 267-0700
Fire Department	Emergency Switchboard	911/(609) 724-3151
Ambulance and Paramedics	Emergency Switchboard	911/(609) 724-4000
Police Department	Emergency Switchboard	911/(609) 724-2001
EPA Emergency Response Team	Switchboard	(800) 424-8802
Program Contacts		
Air Force	Patrick Haas	(210) 536-4314
Battelle	Jeff Kittel	(614)424-6122
	Eric Drescher	(614) 424-3088
McGuire AFB	King Mak	(609) 724-3323
Other		
Emergency Routes		
Hospital (maps provided in Appendix C)		
Other		

The following is a listing of Battelle, AFCEE, and McGuire AFB staff who can be contacted in case of emergency and/or for required technical support during the Bioslurper Initiative tests at McGuire AFB.

Battelle POCs	Jeff Kittel	(614) 424-6122
	Eric Drescher	(614) 424-3088
AFCEE POC	Patrick Haas	(210) 536-4314
McGuire AFB POC	King Mak/Sgt. Evans	(609) 724-3323
Regulatory POCs		

7.0 REFERENCE

Battelle. 1995. *Test Plan and Technical Protocol for Bioslurping*. Prepared by Battelle Columbus Operations for the U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

APPENDIX A

GEOLOGIC CROSS-SECTIONAL PROFILES, GEOTECHNICAL DATA, AND WELL INSTALLATION LOGS FOR THE BFSA, MCGUIRE AFB, NJ

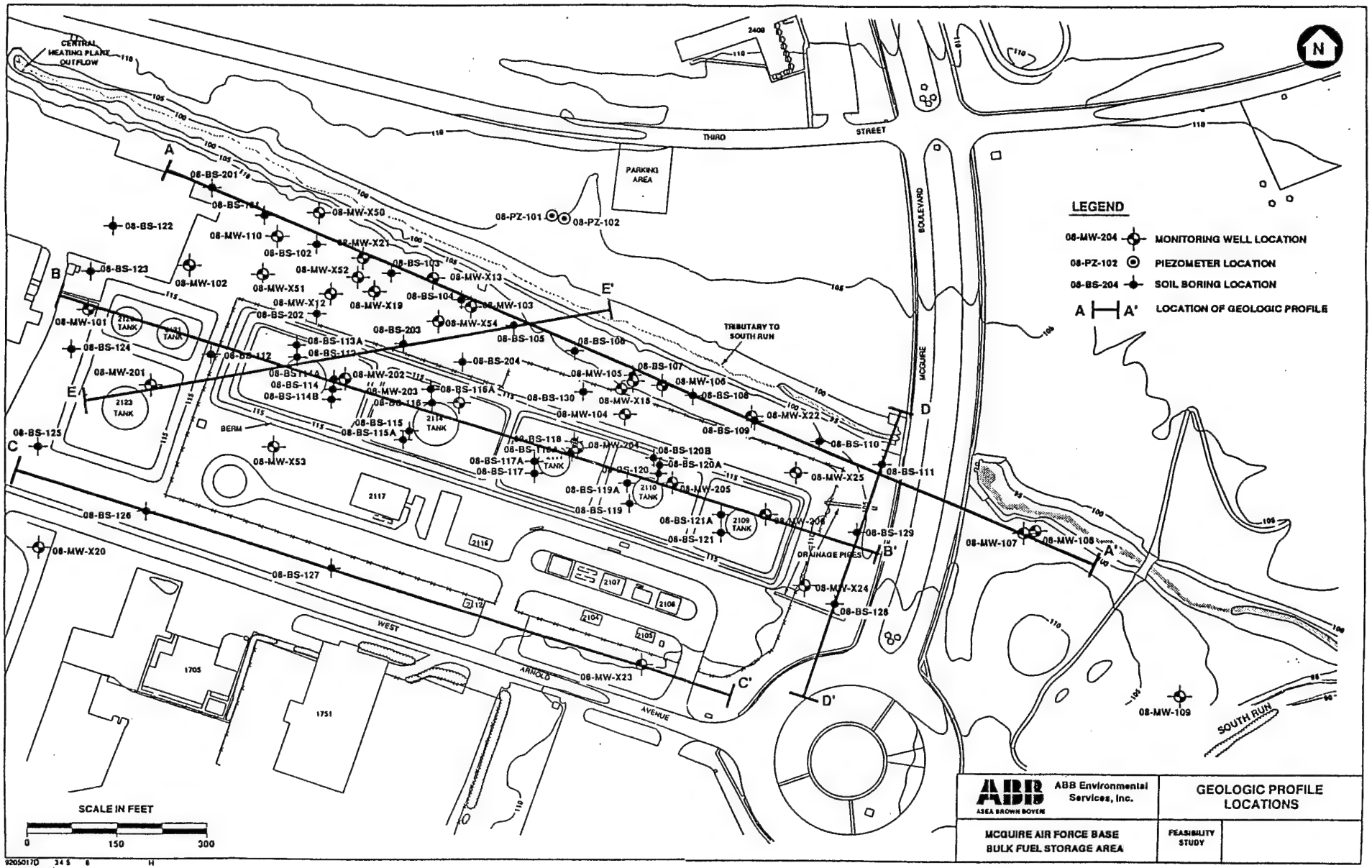
CENTRAL HEATING PLANT OUTFLOW
THIRD STREET
PARKING AREA
BOULEVARD
MCGUIRE
TRIBUTARY TO SOUTH RUN
BERM
DRAINAGE PIPES
WEST ARNOLD AVENUE
SOUTH RUN
LEGEND
08-MW-204 MONITORING WELL LOCATION
08-PZ-102 PIEZOMETER LOCATION
08-BS-204 SOIL BORING LOCATION
A A' LOCATION OF GEOLOGIC PROFILE
SCALE IN FEET
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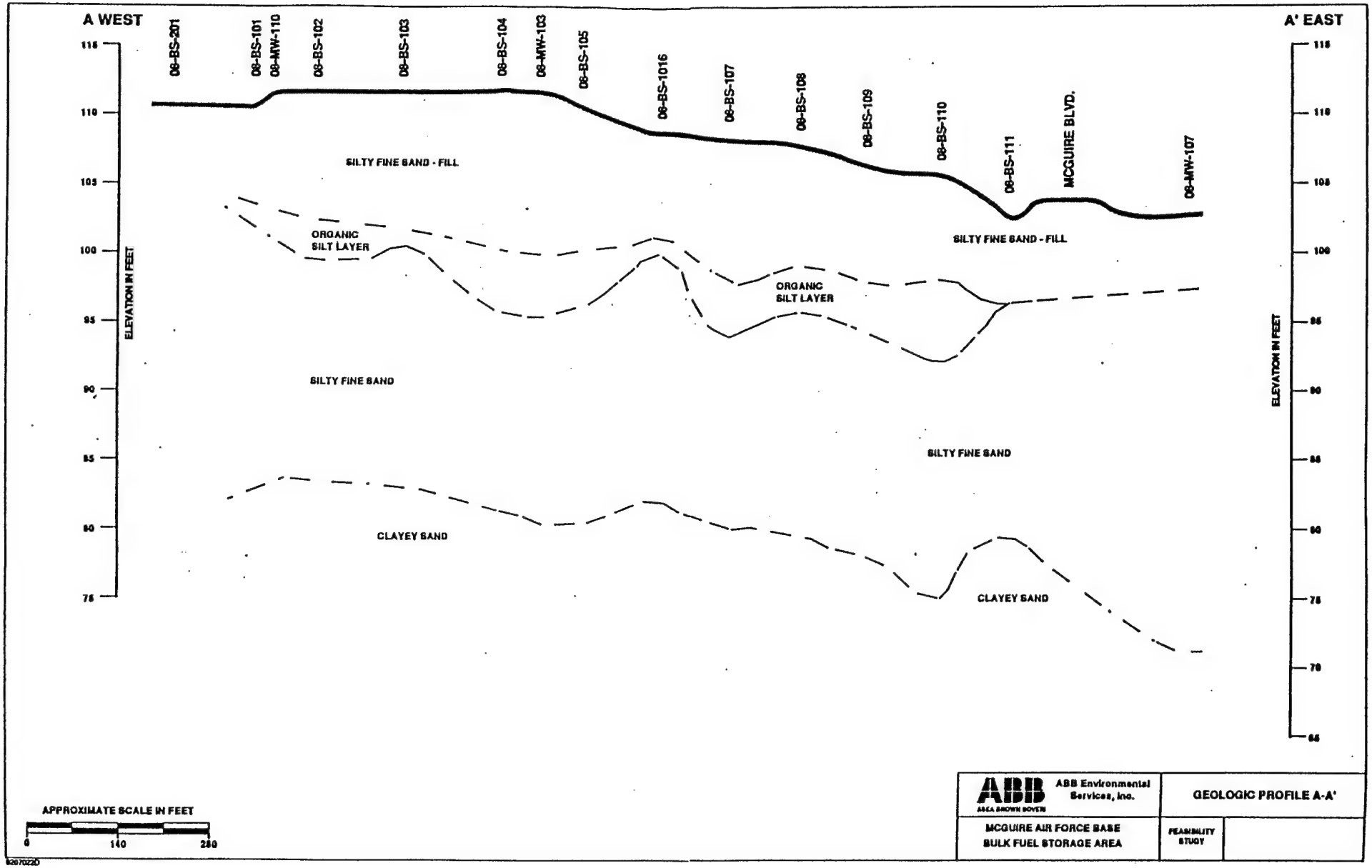
ABB Environmental Services, Inc.
GEOLOGIC PROFILE LOCATIONS
MCGUIRE AIR FORCE BASE
BULK FUEL STORAGE AREA
FEASIBILITY STUDY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A' EAST
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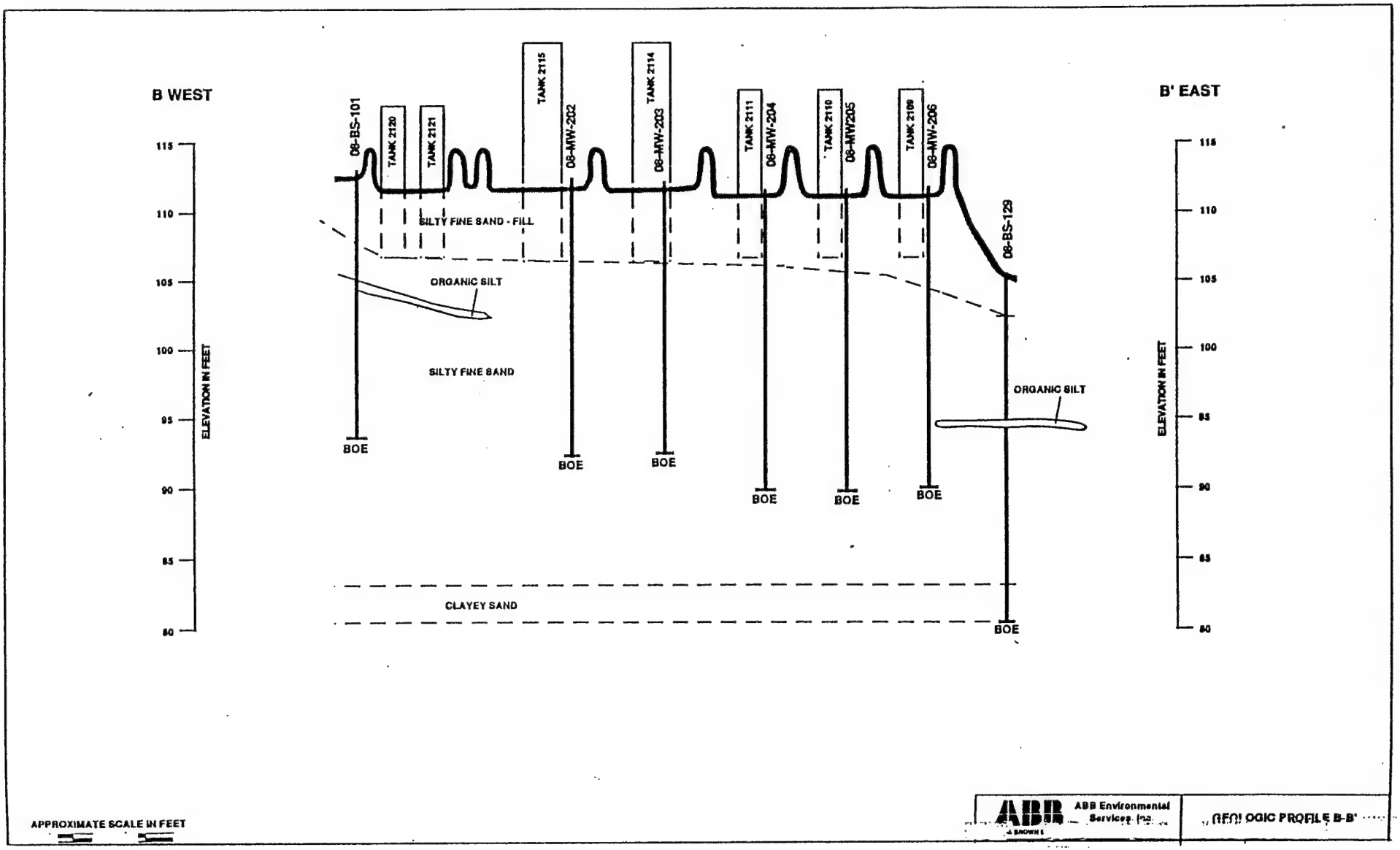
06-BS-101
06-MW-110
06-BS-102
06-BS-103
06-BS-104
06-MW-103
06-BS-105
06-BS-1016
06-BS-107
06-BS-108
06-BS-109
06-BS-110
06-BS-111
MCGUIRE BLVD.
06-MW-107
ELEVATION IN FEET
115
110
105
100
95
90
85
80
75
70
65
SILTY FINE SAND - FILL
ORGANIC SILT LAYER
SILTY FINE SAND
CLAYEY SAND
APPROXIMATE SCALE IN FEET
0
140
280
ABB Environmental Services, Inc.
GEOLOGIC PROFILE A-A'
MCGUIRE AIR FORCE BASE
BULK FUEL STORAGE AREA
FEASIBILITY STUDY


B WEST
B' EAST
ELEVATION IN FEET
115
110
105
100
95
90
85
80
08-BS-101
TANK 2120
TANK 2121
TANK 2115
08-MW-202
TANK 2114
08-MW-203
TANK 2111
08-MW-204
TANK 2110
08-MW-205
TANK 2109
08-MW-206
08-BS-129
SILTY FINE SAND - FILL
ORGANIC SILT
SILTY FINE SAND
ORGANIC SILT
CLAYEY SAND
BOE
BOE
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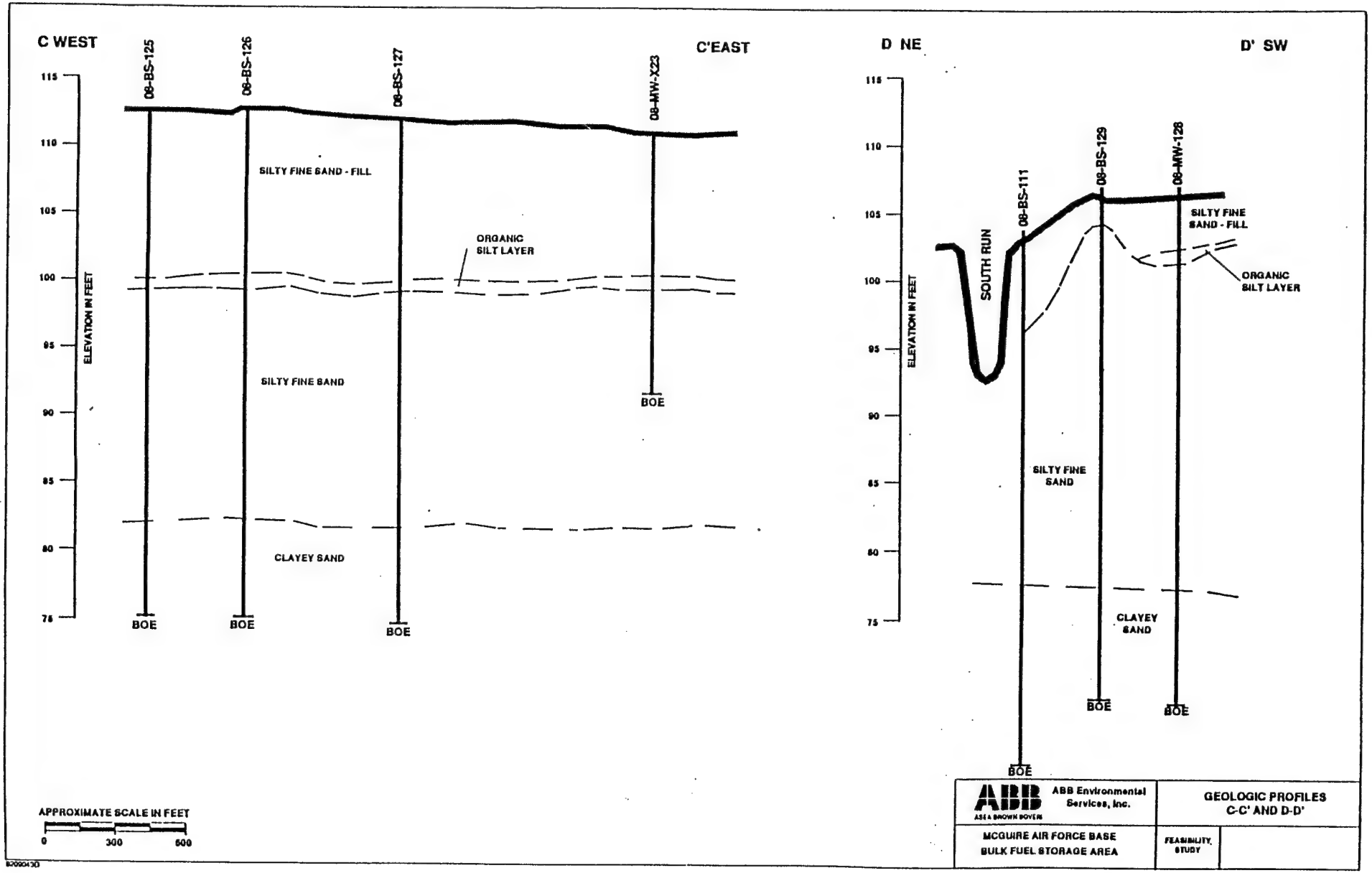
APPROXIMATE SCALE IN FEET
ABB Environmental Services Inc.
GEOLOGIC PROFILE B-B'


C WEST
C'EAST
08-BS-125
08-BS-126
08-BS-127
08-MW-X23
115
110
105
100
95
90
85
80
75
ELEVATION IN FEET
SILTY FINE SAND - FILL
ORGANIC SILT LAYER
SILTY FINE SAND
CLAYEY SAND
BOE
BOE
BOE
BOE
D NE
D' SW
08-BS-111
08-BS-129
08-MW-128
SOUTH RUN
SILTY FINE SAND - FILL
ORGANIC SILT LAYER
SILTY FINE SAND
CLAYEY SAND
BOE
BOE
BOE
APPROXIMATE SCALE IN FEET
0
300
600
ABB Environmental Services, Inc.
ABB
ASEA BROWN BOVERI
GEOLOGIC PROFILES C-C' AND D-D'
MCGUIRE AIR FORCE BASE
BULK FUEL STORAGE AREA
FEASIBILITY STUDY

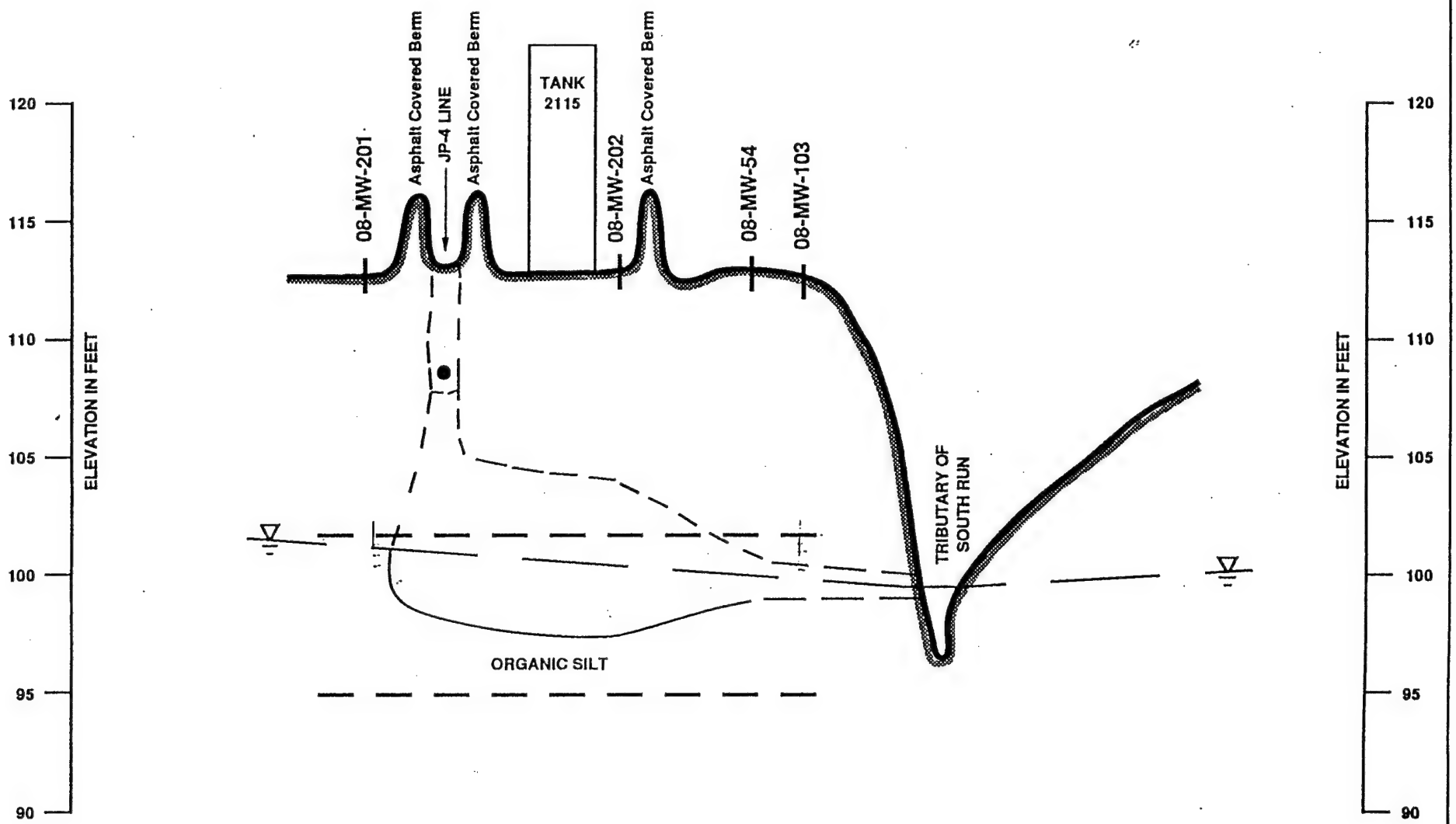


ABB Environmental Services, Inc.	GEOLOGIC PROFILE E-E'
MCGUIRE AIR FORCE BASE BULK FUEL STORAGE AREA	FEASIBILITY STUDY

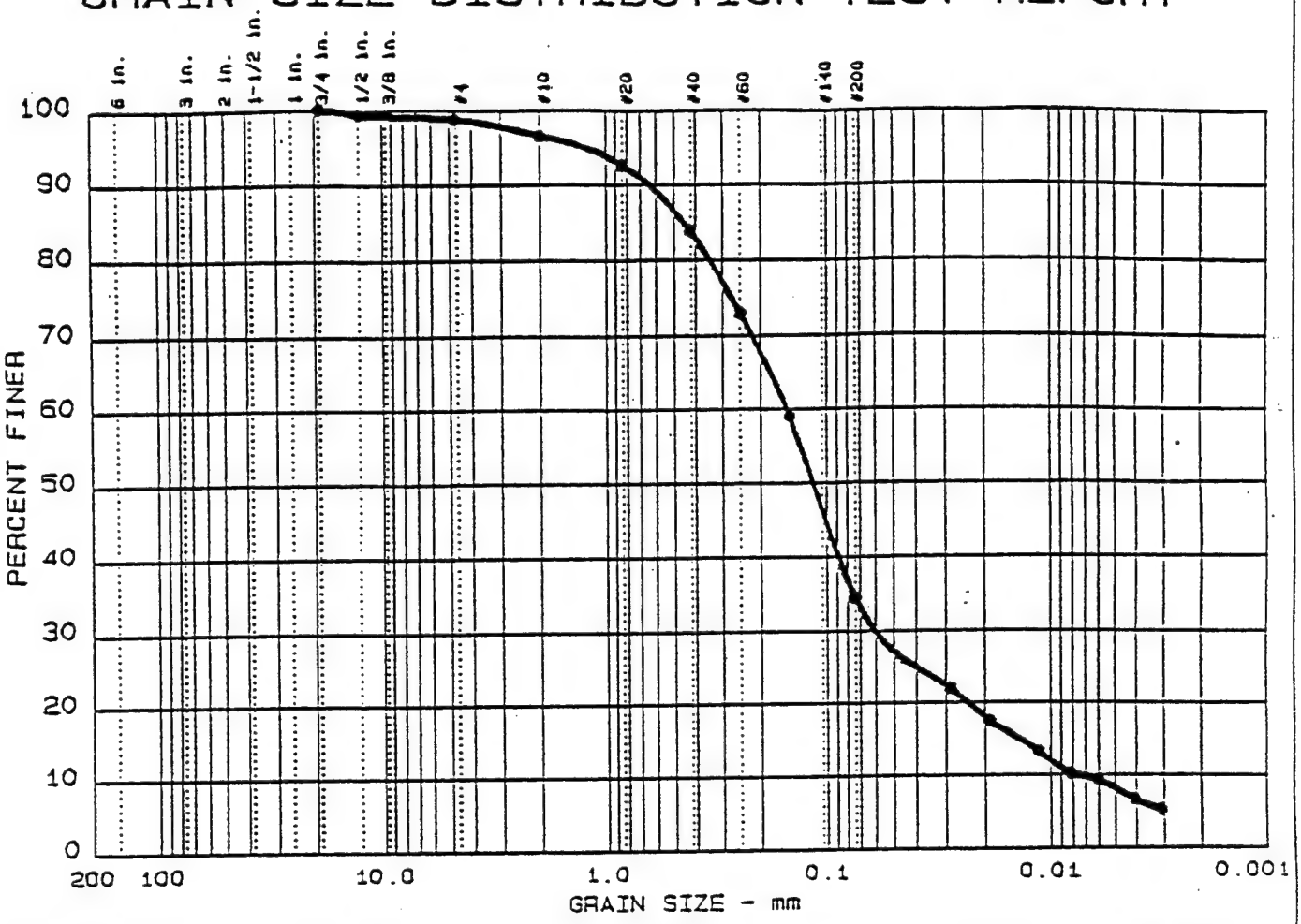
MCGUIRE AIRFORCE BASE
WRIGHTSTOWN, NEW JERSEY
SUMMARY OF UNIT WEIGHT DETERMINATIONS

LAB NO.	SAMPLE IDENTIFICATION	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	BULK (MOIST) DENSITY (pcf)
1209.001	08BS20100801XX	21.5	106.5	129.4
1209.002	08BS20100801XX	21.5	107.5	130.6
1209.003	08BS20400801XX	40.1	76.5	107.2
1209.004	08BS20400801XX	37.3 *	80.5	110.6
1230.001	04SD20100001XX	27.3	88.7	112.9
1230.002	04SD20200001XX	30.3	86.2	112.3
1230.003	04SD20300001XX	54.8	62.3	96.4
1230.004	04SD20100001XX	49.5	65.5	97.9

9

* MINOR LEAKAGE OF WATER PAST FOIL AND TAPE SEAL NOTED UPON RECEIPT OF SAMPLE. RESULTS MAY BE INFLUENCED BY MOISTURE LOSS.

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	3	0.0	1.3	64.4	26.2	8.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.45	0.15	0.12	0.061	0.0141	0.0079	3.09	19.5

MATERIAL DESCRIPTION	USCS	AASHTO
● BROWN SAND, Some Silt, tr clay & grvl, ORGANICS		

Project No.: G040.004
Project: McGUIRE AIR FORCE BASE
● Location: 04S020300001XX

Date: MAY 21, 1992

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC

Remarks:

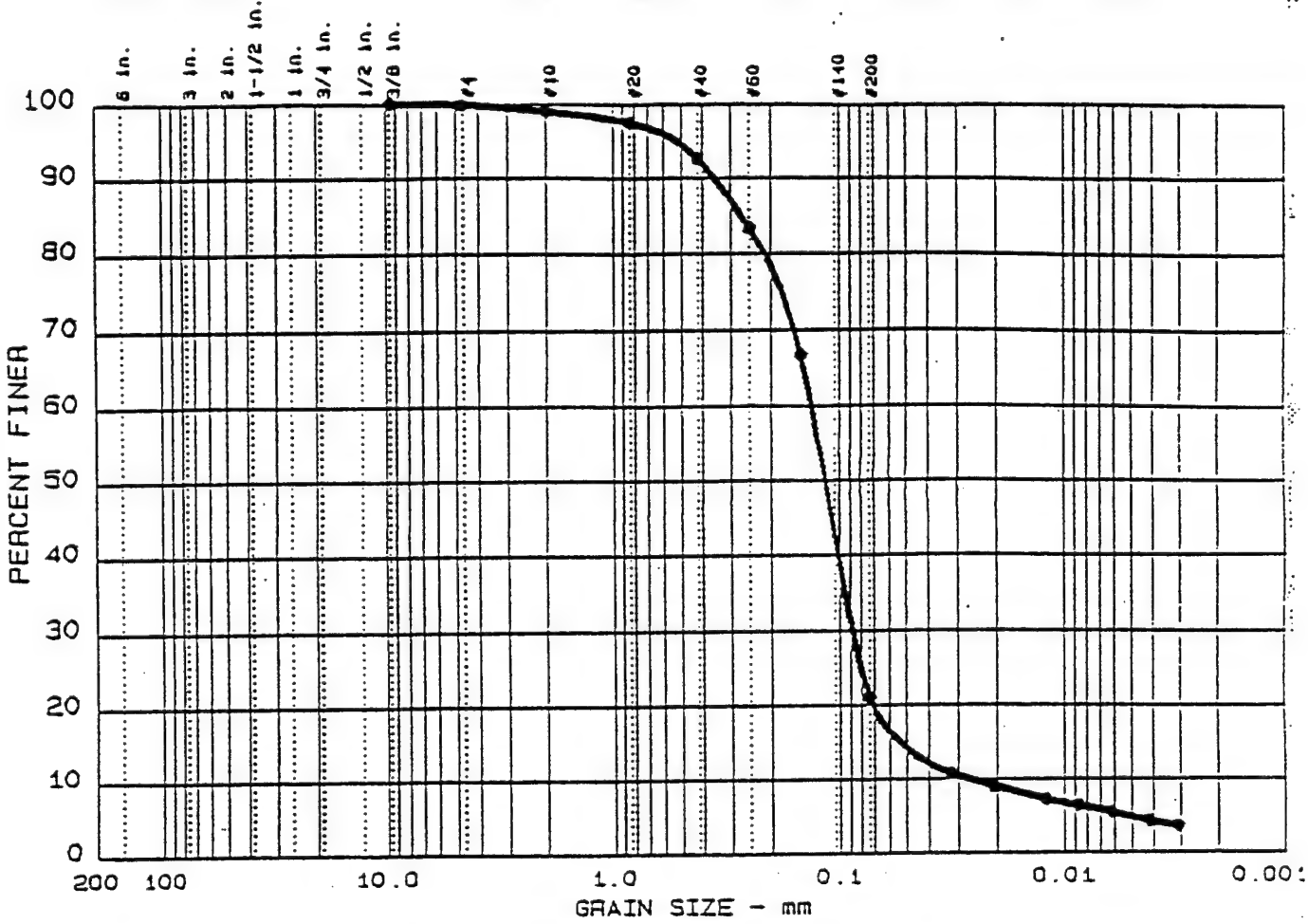
CLIENT: ABB ENVIROMENTAL SERVICES

WATER CONTENT: 49.3%

LAB NO. 1230.003

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	4	0.0	0.2	78.7	16.3	4.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.27	0.13	0.12	0.088	0.0531	0.0272	2.13	4.9

MATERIAL DESCRIPTION	USCS	AASHTO
● BROWN SAND, Little Silt, tr clay & grvl, ORGNCS		

Project No.: G040.004
Project: McGUIRE AIR FORCE BASE
● Location: 08S020100001XX

Date: MAY 21, 1992

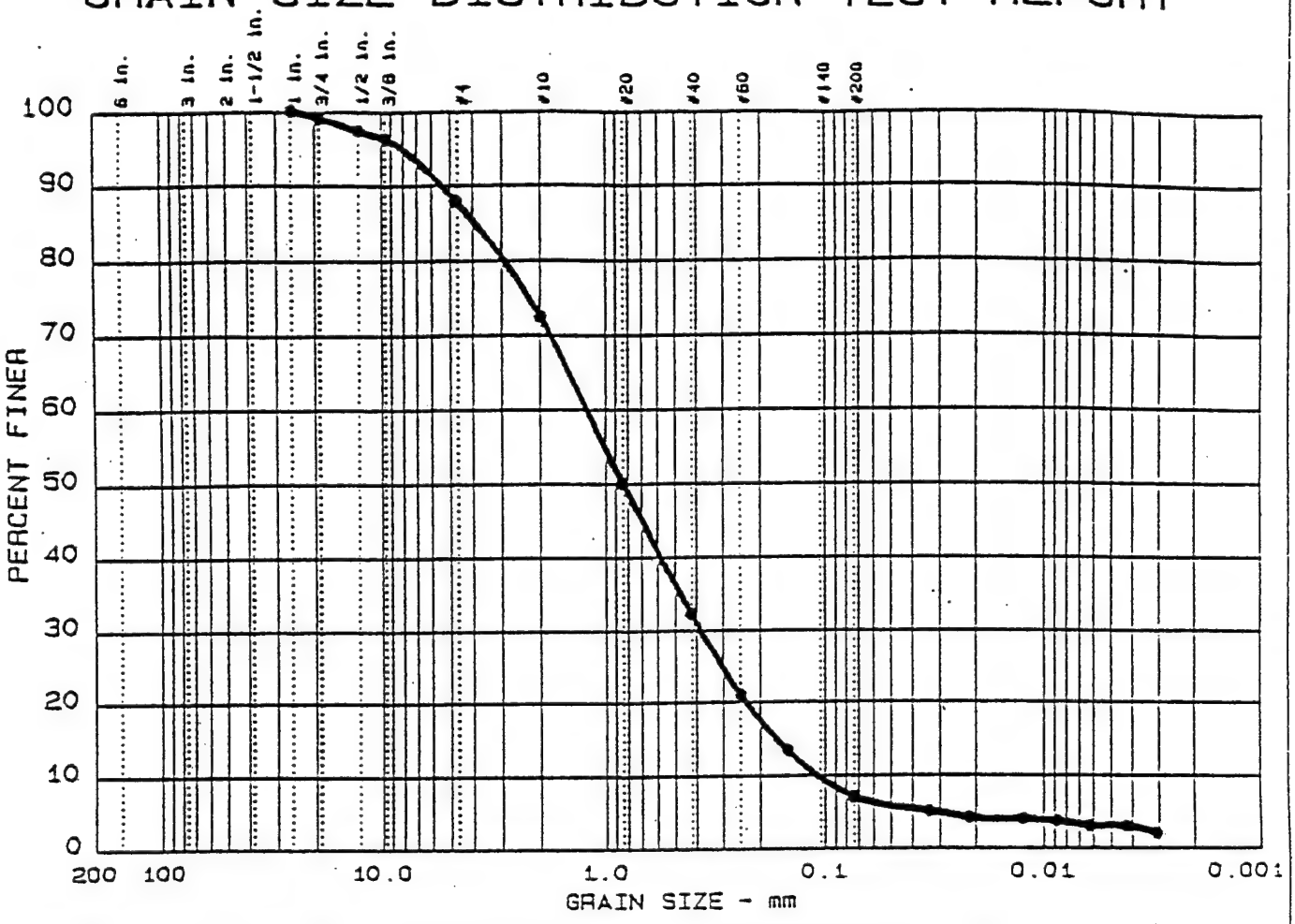
Remarks:
CLIENT: ABB ENVIROMENTAL SERVICES
WATER CONTENT: 50.0%
LAB NO. 1230.004

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	1	0.0	12.1	80.9	3.9	3.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			3.94	1.21	0.84	0.384	0.1675	0.1094	1.11	11.1

MATERIAL DESCRIPTION	USCS	AASHTO
● BROWN SAND, Ltle Gravel, tr silt & clay, ORGNCS		

Project No.: G040.004
Project: McGUIRE AIR FORCE BASE
● Location: 04SD20100001XX

Date: MAY 21, 1992

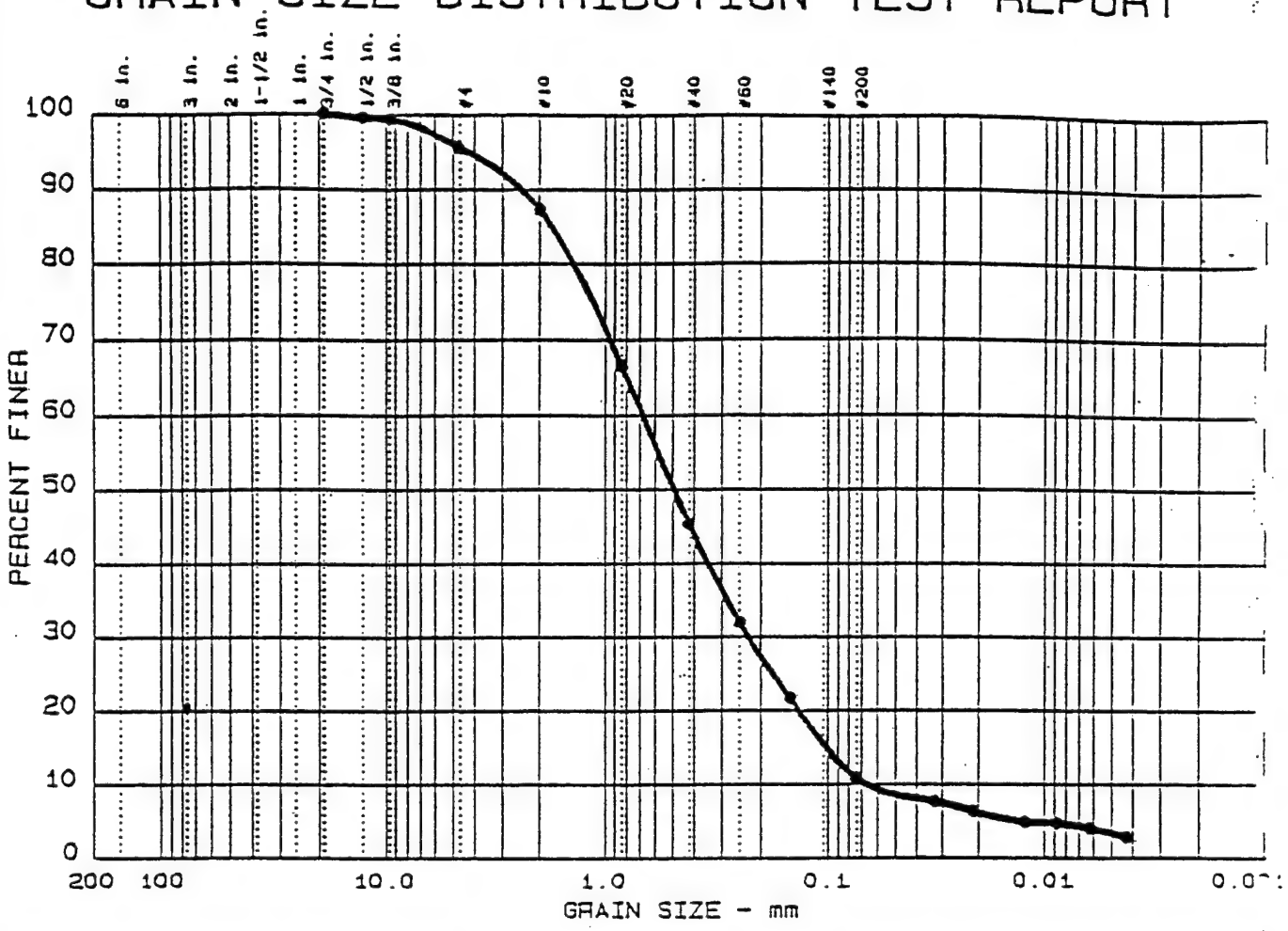
Remarks:
CLIENT: ABB ENVIROMENTAL SERVICES
WATER CONTENT: 22.3%
LAB NO. 1230.001

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	2	0.0	4.4	84.9	7.4	3.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			1.76	0.68	0.49	0.229	0.1023	0.0676	1.15	10.0

MATERIAL DESCRIPTION	USCS	AASHTO
● BROWN SAND, trace silt & grvl & clay, ORGANICS		

Project No.: G040.004
Project: McGUIRE AIR FORCE BASE
● Location: 04SD020200001XX

Date: MAY 21, 1992

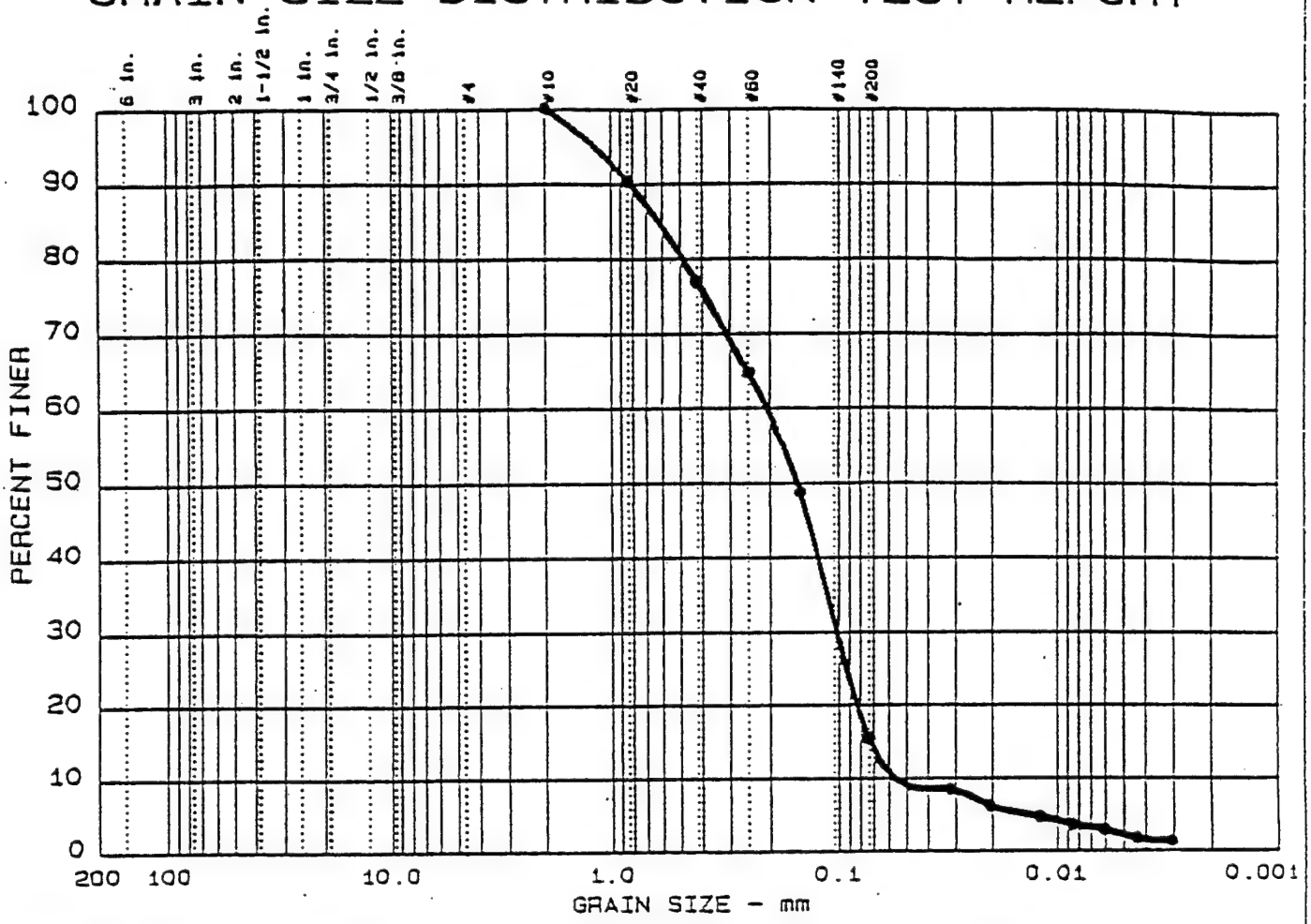
Remarks:
CLIENT: ABB ENVIROMENTAL SERVICES
WATER CONTENT: 41.8%
LAB NO. 1230.002

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	1	0.0	0.0	84.5	13.3	2.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.62	0.21	0.15	0.102	0.0724	0.0569	0.89	3.6

MATERIAL DESCRIPTION	USCS	AASHTO
● BLACK SAND, Little Silt, tr clay, ORGANICS		

Project No.: G040.004
Project: McGUIRE AIR FORCE BASE WRIGHTSTOWN NJ
● Location: 088S20100801XX

Date: APRIL 29, 1992

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC

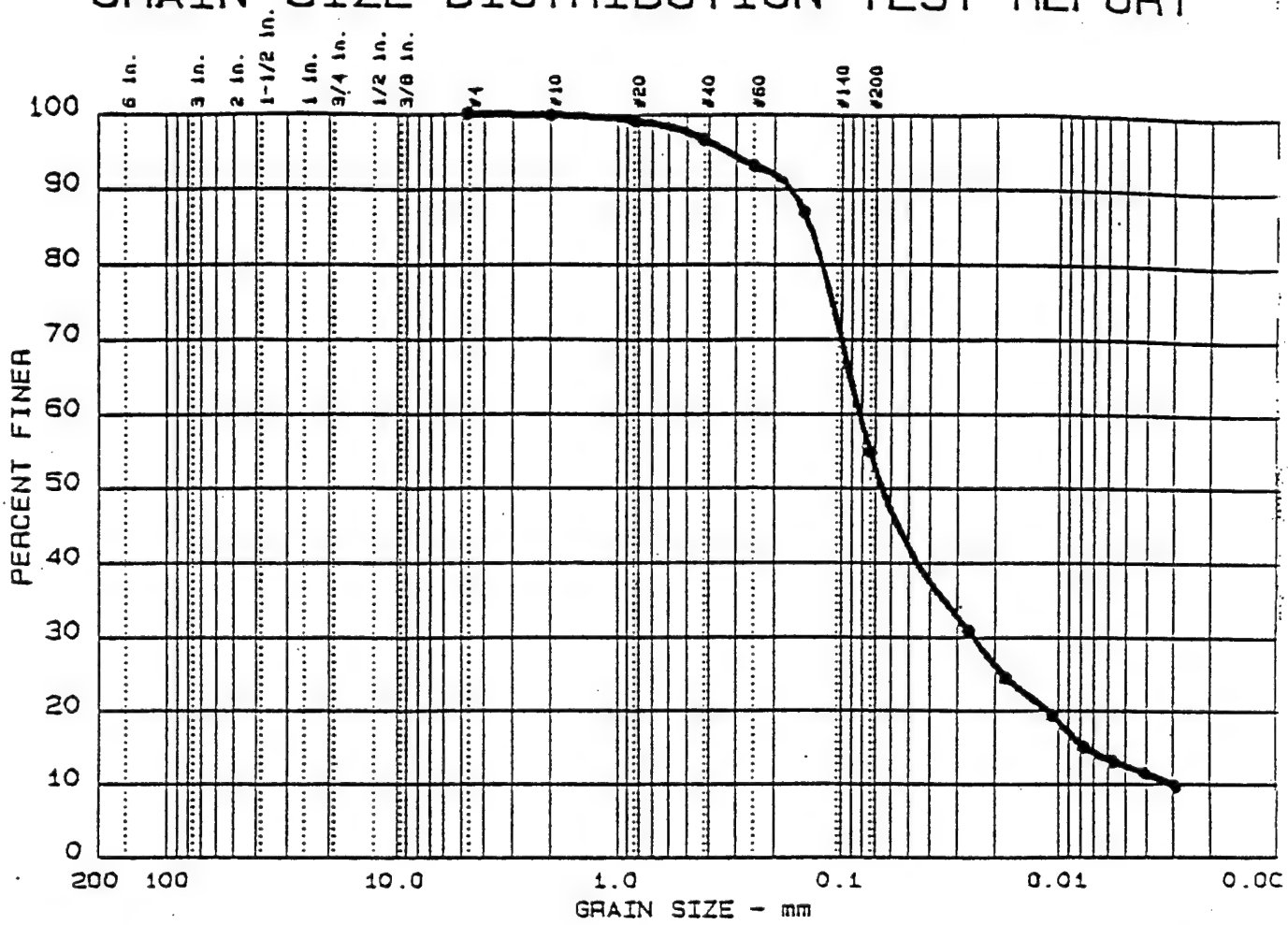
Remarks:

CLIENT: ABB ENVIRONMENTL SERVICES, INC.

LAB NO. 1209.001

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	2	0.0	0.0	45.2	42.4	12.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.14	0.08	0.07	0.025	0.0076	0.0031	2.51	27.0

	MATERIAL DESCRIPTION	USCS	AASHTO
●	BROWN SAND AND SILT, Little Clay, ORGANICS		

Project No.: G040.004
Project: McGUIRE AIR FORCE BASE WRIGHTSTOWN NJ
● Location: 08BS20400801XX

Date: APRIL 29, 1992

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC

Remarks:

CLIENT: ABB ENVIRONMENTL SERVICES, INC.

LAB NO. 1209.003

Figure No. 1

ABB ENVIRONMENTAL SERVICES, Inc.

08BS101

Project	Site	Project No.
McGUIRE AIR FORCE BASE RI/FS	McGUIRE AFB	6623-04

Client	Logged By	Checked By	Ground Elev
HAZWRAP	NWH/CFR		111.32

Drilling Contractor	Driller's Name	Rig Type	Start Date	Finish Date
MATHES OF NEW JERSEY	STEVE KOVALESKY	ATV	01/10/91	01/12/91

Drilling Method	Protection Level	P.I.D. (eV)	Casing Size	Auger Size
Hollow Stem Auger	MOD. D	10.2	N/A	4.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez.	Boring	Well
37.0	N/A	37.0	14.00 - 01/12/91	☐	☒	☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.8/2.0		8/10/33/24	43		0.0-1.3: Black organics, coal or degraded fuel.	ML		97.8	75.0		F
	S-2 1.8/2.0		10/20/22/28	42		1.3-2.0: Tan SILT; dry; medium dense. 2.0-2.5: Brown Silty fine SAND; some black organics; dry; dense.	SM		174.0	174.0		F
5	S-3 2.0/2.0		12/12/25/70	37		2.5-4.0: Tan fine SAND; poorly graded; dry; medium dense.	SM		256.0	261.0		L
	S-4 0.6/1.6		6/6/50/50	56		Tan and gray to black fine SAND and SILT; heavily stained; top 0.6 foot very wet.	GM		8.8	249.0		F
	S-5 1.3/2.0		20/12/10/8	22		6.0-8.4: Black SILT; heavily stained; Sandy Gravel; wet.	GM		837.0	171.0		L F
10	S-6 0.8/2.0		12/16/16/18	32		8.4-8.8: Black stained PEAT; some rootlets; dry. 8.8-9.3: Black stained CLAY; little fine to medium Sand; dry.	SM		40.0	243.0		F
	S-7 1.4/2.0		4/9/11/13	20		Gray SILT and SAND; trace Gravel; trace organic matter; moist.	SM		4.3	68.0		
	S-8 1.5/2.0		8/12/16/16	28		Gray Silty fine SAND; moist. Similar to S-7; wet.	SM		7.3	4.3		F
20	S-9 1.5/2.0		6/6/8/16	14		Similar to S-8.	SM		0.6	2.6		F
25	S-10 2.0/2.0		10/13/16/16	29		25.0-26.3: Similar to S-8. 26.3-27.0: Green to gray Clayey fine to medium SAND; wet.	SC		BKG	2.9		F
30	S-11 2.0/2.0		10/12/16/18	28		Similar to S-10; white shell fragments.	SC		BKG	BKG		F
35	S-12 2.0/2.0		7/14/21/22	35		Similar to S-11.	SC	1	BKG	BKG		F
40						**BOTTOM OF EXPLORATION AT 37.0 FEET** NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS102

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		Proje: 662:
Client HAZWRAP		**Logged By** SJC/BCM	**Checked By**	Groun 111.:
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/11/91	Finish 02/1
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	Auger 4.25"
Soil Drilled (ft) 38.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 38.0	**Depth to Water (ft)-Date** 8.20 - 02/12/91	**Piez.Boring** ☐ ☒

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE WELL
	S-1 1.7/2.0		18/21/30/22	51		0.0-0.3: TOPSOIL 0.3-1.0: Tan Silty fine to medium SAND; damp.	SM		BKG	0.2
	S-2		12/21/18/24	39		1.0-1.4: Black Coal Ash. 1.4-1.7: Brown Silty fine SAND; damp.	SM		BKG	0.2
5	S-3 1.8/2.0		6/8/12/21	20		Rust to olive-green Silty fine SAND; mottled; damp. Similar to S-2.	SM		BKG	0.2
	S-4 1.2/2.0		6/36/28/10	64		6.0-6.3: Brown fine SAND; trace coarse Sand; trace Silt; moist to wet.	SP		BKG	102.5
	S-5 0.7/2.0		5/10/6/3	16		6.3-6.6: Black Coal Ash in coarse SAND. 6.6-7.2: White to gray GRAVEL; angular; dry.	SW		BKG	262.0
10	S-6 0.6/2.0		1/2/3/2	5		Black stained SAND; well graded; wet; loose.	SM		BKG	144.9
	S-7 1.6/2.0		4/6/5/8	11		Brown Silty SAND; trace subrounded Gravel; trace roots; wet.	SM		BKG	4.5
	S-8 1.4/2.0		6/5/5/8	10		12.0-12.9: Black organic fine Silty SAND; damp; loose. 12.9-13.6: Gray fine Silty SAND; 1/4 inch Silt seam at 13.1 feet; wet; loose.	SM		BKG	1.5
15	S-9 1.3/2.0		5/8/10/14	18		14.0-14.5: Gray SAND; trace coarse Gravel; well graded; wet; loose. 14.5-15.4: Dark gray Silty fine SAND; wet; dense. Similar to S-8.	SM		BKG	157.4
20										
	S-10 1.4/2.0		5/7/7/8	14		Similar to S-8.	SM		BKG	1.5
25	S-11 0.9/2.0		3/6/8	14		Similar to S-8.	SM		BKG	0.8
30	S-12 1.5/2.0		5/4/7	11		Dark gray medium to fine Clayey SAND; trace Silt; shell fragments; wet.	SC		BKG	1.7
35	S-13		5/7/11/17	18		Similar to S-12; some cemented Sand grains to 3/4 inch; wet.	SC	1	BKG	1.4
40						BOTTOM OF EXPLORATION AT 38.0 FEET				

NOTES:
1. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS103

Project	Site	Project No.
McGUIRE AIR FORCE BASE RI/FS	McGUIRE AFB	6623-04

Client	Logged By	Checked By	Ground Elev
HAZWRAP	SJC		111.90

Drilling Contractor	Driller's Name	Rig Type	Start Date	Finish Date
MATHES OF NEW JERSEY	MIKE LOGAN	D-50	02/10/91	02/10/91

Drilling Method	Protection Level	P.I.D. (eV)	Casing Size	Auger Size
Hollow Stem Auger	MOD. D	10.2	N/A	4.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez.	Boring	Well
37.0	N/A	37.0	11.60 - 02/10/91	☐	☒	☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.5/2.0		6/18/23/29	41		0.0-1.0: Tan fine SAND; some Silt; roots; damp. 1.0-2.3: Black Coal Ash.	SM		BKG	1.0		L F
	S-2 1.2/2.0		16/19/27/37	46		2.3-2.6: Rust to red fine to medium SAND; cemented; damp.	SP-SM		BKG	0.5		
5	S-3 1.6/2.0		10/12/21/28	33		2.6-9.5: Green to brown to black Silty fine SAND; moist.	SM		BKG	0.8		F
	S-4 2.0/1.6		20/18/18/19	36			SM		BKG	2.6		
	S-5 1.5/1.5		9/6/6	12			SM		BKG	0.5		L F
10	S-6 1.8/2.0		12/11/11/11	22		11.0-12.3: Olive-green to black Silty fine SAND; some wood; damp.	SM		BKG	2.1		L F
	S-7 1.5/1.5		6/9/11	20		12.3-12.8: Black organic SILT; some roots; moist.	SM		BKG	0.5		F
15	S-8 1.5/1.5		19/23/26	49		Gray Silty fine SAND; wet; layers of brown organic Silt from 13.5 to 13.8 feet and 14.1 to 14.5 feet. Similar to S-7; Silt layer from 14.8 to 15.4 feet.	SM		BKG	13.1		
20	S-9 1.5/1.5		6/9/12	21		Dark gray Silty fine SAND; trace medium Sand; dilatent; wet.	SM		BKG	0.3		L
25	S-10 1.5/1.5		6/9/14	23		Dark brown fine Sandy SILT; wet.	ML		BKG	0.8		F
30	S-11 2.0/2.0		4/6/7/9	13		Green to gray fine to medium Clayey SAND; some shell fragments; wet.	SC		BKG	0.2		
35	S-12 2.0/2.0		10/12/21/14	35		Similar to S-11.	SC	1	BKG	0.4		L F
40						**BOTTOM OF EXPLORATION AT 37.0 FEET** NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS104

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 112.23
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/09/91	**Finish Date** 02/09/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 7.00 - 02/09/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.2/2.0		2/6/6/8	12		0.0-0.5: TOPSOIL 0.5-2.3: Black Coal Ash.	SM		BKG	0.1		
	S-2 1.4/2.0		6/12/17/20	29		2.3-3.4: Green to brown rusty Silty fine SAND; damp.	SM		BKG	0.1		
5	S-3 1.7/2.0		12/17/10/11	27		Similar to S-2; layer coal ash 4.0 to 4.2 feet.	SM		BKG	0.1		F
	S-4 1.5/2.0		6/8/5/4	13		Tan, green to black Silty fine SAND; moist.	SM		BKG	0.3		
	S-5 1.3/2.0		2/4/4/10	8		Similar to S-4; fuel odor.	SM		BKG	153.5		L F
10	S-6 0.4/1.5					Brown to black Silty fine SAND; wood fragments; moist; fuel odor; coal ash layer at 10.0 to 10.1 feet.	SM		BKG	306.0		F
	S-7 0.4/2.0		22/25/22/33	47		11.5-15.3: Black oily WOOD and fine SAND; wet; fuel odor.	SM		BKG	511.0		L F
	S-8		19/23/36	59			SM		BKG	500.0		L F
15	1.0/1.5 S-9 1.2/1.5		17/20/13	33		15.3-16.2: Gray Silty fine SAND; wet; strong fuel odor.	SM		BKG	497.0		F
20	S-10 1.5/1.5		17/23/35	58		Dark gray Silty fine SAND; dilatant; wet; strong fuel odor.	SM		BKG	447.0		F
25	S-11 1.5/1.5		4/8/9	17		Similar to S-10.	SM		BKG	511.0		L F
30	S-12 2.0/2.0		9/11/13/13	24		30.0-30.5: Similar to S-10. 30.5-32.0: Green fine to medium Clayey SAND; some fossil fragments; wet.	SC		BKG	521.0		F
35	S-13 2.0/2.0		5/5/19/20	24		Similar to S-12.	SC	1	BKG	491.0		L E
40						**BOTTOM OF EXPLORATION AT 37.0 FEET** NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS105

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 110.73
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/08/91	**Finish Date** 02/08/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 12.70 - 02/08/91	**Piez.** ☐ **Boring** ☒ **Well** ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.7/2.0		3/5/5/10	10		0.0-0.2: TOPSOIL 0.2-1.3: Coal Ash; Silt seam at 0.8 foot.			BKG	0.1		
	S-2 1.3/2.0		10/12/26/23	38		1.3-2.8: Orange Silty fine SAND; iron staining; layer of coal ash at 2.0 to 2.2 feet.	SM		BKG	0.1		
5	S-3 1.5/2.0		10/9/11/12	20		2.8-8.3: Olive-green Silty fine SAND; damp; layer of black organic Silt at 6.2 to 6.4 feet.	SM		BKG	0.6		L
	S-4 1.2/1.6		9/12/13/16	25			SM		BKG	0.3		
	S-5 1.3/2.0		4/5/4/7	9		8.3-12.7: Olive-green to brown to black organic SILT; some wood; roots; fine Sand laminae.	SM		BKG	1.0		
10	S-6 2.0/2.0		4/7/7/10	14			SM		BKG	0.1		L
	S-7 1.5/2.0		10/35/47	82			SM		BKG	0.1		L
	S-8 1.0/2.0		1/4/15	19		12.7-15.0: Gray fine Silty SAND; some black organic Silt with wood; wet.	SM		BKG	9.0		
15												
20	S-9 1.5/1.5		18/25/33	58		Dark gray Silty fine SAND; wet.	SM		BKG	0.3		F
25	S-10 1.5/1.5		18/25/33	58		Similar to S-9; Silt laminae.	SM		BKG	0.3		
30	S-11 1.5/1.5		9/12/13/16	25		30.0-30.5: Dark brown SILT; some fine Sand; wet. 30.5-32.0: Green fine to medium Clayey SAND; fossiliferous.	SC		BKG	0.1		F
35	S-12 2.0/2.0		9/11/14/204	25		Similar to S-11.	SC	1	BKG	0.3		L
40						**BOTTOM OF EXPLORATION AT 37.0 FEET**						

NOTES:
1. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS106

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 109.12
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/08/91	**Finish Date** 02/08/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 10.40 - 02/08/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.5/2.0		9/12/16/20	28		0.0-0.3: TOPSOIL 0.3-1.5: Tan to green Silty fine SAND; mottled; trace Gravel; black laminae; damp; fuel odor.	SM		BKG	0.1		L F
	S-2 1.5/2.0		1/7/23/23	30			SM		BKG	0.6		
5	S-3 1.4/2.0		10/11/19/21	30		2.0-8.2: Green Silty fine SAND; trace medium Sand; damp; fuel odor.	SM		BKG	2.0		
	S-4 1.4/2.0		11/14/14/23	28			SM		29.4	BKG		F
	S-5 1.6/2.0		9/13/29/30	42		8.2-9.0: Black to brown SILT; little fine Sand; damp.	SM		BKG	0.1		F
10 ▼	S-6 1.5/1.5		1/5/5	10		9.0-12.5: Gray Silty fine SAND; trace medium Sand; wet.	SM		BKG	0.3		
	S-7 1.5/1.5		13/20/27	47			SM		BKG	0.6		F
	S-8 1.5/1.5		3/5/6	11		12.5-15.2: Gray SAND; well graded.	SP		BKG	0.3		L
15	S-9 1.5/1.5		14/20/35	55		15.2-16.0: Brown Silty fine SAND; wet.	SM		BKG	0.3		L
20	S-10 1.5/1.5		9/12/16	28		Brown SILT; little fine Sand; trace Clay; wet.	OL		BKG	0.1		
25	S-11 2.0/2.0		5/5/10/17	15		25.0-26.0: Similar to S-10. 26.0-27.0: Green fine Clayey SAND; little medium Sand; fossilliferous.	SC		BKG	0.3		
30	S-12 2.0/2.0		10/12/14/20	26		Similar to S-11; little Silt.	SC		BKG	0.1		
35	S-13 2.0/2.0		9/12/15/19	27		Similar to S-12.	SC	1	BKG	0.1		L
40						**BOTTOM OF EXPLORATION AT 37.0 FEET** NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS107

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** CEO	**Checked By**	**Ground Elev** 108.60
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/07/91	**Finish Date** 02/07/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 13.00 - 02/07/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1		12/12/16/22	28		Brown Silty fine SAND; black laminae throughout.	SM	1	115.0	334.0		F
	S-2		12/21/25/40	46		2.0-2.3: Black oil stained SAND; well graded; wet.	SP		8.4	195.9		L
						2.3-10.7: Green to tan to black Silty fine SAND;						F
5	S-3		23/15/15/22	30		mottled; trace medium Sand; Gravel layer at 4.0 to 4.3 feet; black laminae; moist.	SM		1.6	9.3		
	S-4		16/24/23/24	47			SM		BKG	2.3		F
	S-5		10/12/7/12	19			SM		BKG	2.0		
10	S-6		6/7/7	14			SM		3.2	131.0		L
	S-7		3/4/16	20		10.7-14.5: Layers of green Silty fine SAND and black organic SILT with roots and wood; layers	OL		3.2	19.3		L
	S-8		13/20/28	48		approximately 0.3 to 0.7 foot thick; wet below 13.0 feet.	SM		BKG	0.6		F
15	S-9		3/5/8	13		Tan to gray Silty fine SAND; trace medium Sand; wet.	SM		BKG	0.3		
20	S-10		3/6/8/9	14		Gray SAND; well graded; trace Gravel; wet.	SP		BKG	0.8		
25	S-11		16/19/30/40	49		25.0-25.9: Brown to light gray Silty fine SAND; little medium Sand; trace coarse Sand; wet.	SM		BKG	1.0		F
						25.9-27.0: Dark green to black Clayey fine SAND; trace medium Sand; wet.						
30	S-12		9/16/22/30	38		Light green Clayey fine SAND; fossilliferous; wet.	SC			0.1		
35	S-13		10/14/20/29	34		Similar to S-12.	SC	2	BKG	BKG		L F
40						**BOTTOM OF EXPLORATION AT 37.0 FEET**						

NOTES:
1. Recovery/penetration not recorded.
2. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS108

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 108.10
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/07/91	**Finish Date** 02/07/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez	Boring	Well
37.0	N/A	37.0	10.00 - 02/07/91	☐	☒	☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1		4/9/13/16	22		0.0-0.4: TOPSOIL	SM		BKG	BKG		L
	S-2		6/13/26/26	39		0.4-10.8: Brown to green Silty fine SAND; trace medium and coarse Sand; black laminae; Silt layers; Sand layers; damp; fuel odor.	SM	1	2.4	7.4		
5	S-3		12/12/12/18	24			SM		2.4	12.6		
	S-4		14/19/21/29	40			SM		0.8	0.8		L
	S-5		2/3/4/4	7			SM		BKG	0.3		F
10	S-6		1/4/4/10	8			SM		BKG	0.6		L
	S-7		7/8/8/10	16		10.8-15.5: Layers of gray Silty fine SAND and black organic SILT 0.2 to 1.2 feet thick.	OL		BKG	0.3		F
15	S-8		7/11/12/15	23			SM		BKG	0.3		
20	S-9		9/11/12/12	23		Brown SILT; some fine to medium Sand; damp.	ML		BKG	0.3		
25	S-10		1/3/7/7	10		25.0-25.4: Similar to S-9. 25.4-27.0: Dark green Silty fine SAND; little medium Sandy brown Silt laminae throughout.	SM		BKG	0.1		
30	S-11		14/17/18/22	35		Green to gray fine to medium Clayey SAND; some Silt; fossilliferous clusters of calcified Sand.	SC		BKG	0.3		
35	S-12		13/18/26/33	44		Similar to S-11.	SC	2	BKG	0.1		L
40						**BOTTOM OF EXPLORATION AT 37.0 FEET** NOTES: 1. Recovery/penetration not recorded. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS109

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 106.86
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/04/91	**Finish Date** 02/04/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 11.70 - 02/04/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1		6/10/20	30		0.0-1.0: TOPSOIL	SM	1	BKG	23.3		L
	S-2		18/20/24	44		1.0-8.5: Olive-green to dark brown Silty fine SAND.	SM		BKG	21.3		F
	S-3		9/15/19/19	34			SM		BKG	9.5		
5	S-4		9/14/15/14	29			SM		0.9	6.1		L F
	S-5		4/8/8/8	16			SM		0.3	3.0		
	S-6		6/8/13/17	21		8.5-14.5: Layers of gray Silty fine SAND and black organic SILT; rootlets and bioturbation; wet below 12.0 feet.	OL		BKG	1.1		L
10	S-7		11/8/14	22			SM		BKG	1.1		L
	S-8		12/18/14/12	32			OL		BKG	0.7		
15												
20	S-9		4/6/8	10		Dark brown to light gray Silty fine SAND; some roots and bark.	SM		BKG	0.7		
25	S-10		3/8/8/8	16		Black fine SAND; some medium Clayey Sand; some Silt; trace roots; wet.	SC		BKG	0.7		
30	S-11		6/15/18/21	33		Green to dark green fossilliferous fine to medium SAND; wet.	SC		BKG	0.7		
35	S-12		1/13/17/21	30		Similar to S-11.	SC	2	BKG	0.7		
40						**BOTTOM OF EXPLORATION AT 37.0 FEET**						

NOTES:
1. Penetration/recovery not recorded.
2. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS110

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BBJ	**Checked By**	**Ground Elev** 106.07
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/29/91	**Finish Date** 01/29/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)–Date** 8.40 – 01/29/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.8/2.0		10/21/35/35	56		0.0-0.2: TOPSOIL	SM	1		0.6		F
	S-2 1.7/2.0		10/12/21/23	33		0.2-8.6: Tan to black stained Silty fine SAND; trace medium to coarse Sand; Gravel layer at 1.2 to 2.0 feet; wood fragments at 0.9, 2.0, and 7.5 feet; moist.	SM			2.8		
5	S-3 1.9/2.0		10/14/18/21	32			SM			0.0		F
	S-4 2.0/2.0		13/15/10/9	25			SM			0.9		F
	S-5 1.5/1.5		3/6/12	18			SM			2.0		
10	S-6 1.5/1.5		3/5/10	15		8.6-15.0: Layered brown SILT with sticks and roots; brown to black stained Silty fine SAND.	SM			0.4		
	S-7 1.6/2.0		4/4/4/8	8			OL			1.2		
	S-8 2.0/2.0		3/3/4/5	7			SM			0.9		
15												
20	S-9 1.8/2.0		7/7/9/15	16		Brown SAND; well graded; some fine Gravel; brown organic Silt in bottom of spoon; wet.	SP			BKG		
25	S-10 2.0/2.0		12/16/17/22	33		Green to black Clayey fine SAND; little medium Sand; wet.	SC			BKG		
30	S-11 2.0/2.0		9/11/12/22	23		30.0-31.1: Similar to S-10. 31.1-32.0: Light green Clayey fine SAND; moist; very stiff.	SC			BKG		
35	S-12 2.0/2.0		12/18/27/30	45		Similar to S-11 (31.1-32.0); fossilliferous.	SC	2		BKG		
40						**BOTTOM OF EXPLORATION AT 37.0 FEET**						

NOTES:
1. PI field scan not recorded. 2. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS111

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 103.04
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/15/91	**Finish Date** 01/15/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 7.50 - 01/15/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.0/2.0		5/10/21/35	31		Brown SAND; well graded; moist.	SP		BKG	BKG		L
	S-2 0.0/2.0		3/7/9/16	16		No Recovery	SP		BKG	BKG		
5	S-3 0.3/2.0		4/4/6/4	10		Brown SAND; well graded; moist.	SP		BKG	BKG		
	S-4 0.0/2.0		5/9/8/10	17		6.0-16.0: Layers of dark brown organic SILT and brown to gray Silty fine SAND; wet below 7.5 feet.	OL		BKG	0.4		L F
	S-5 1.0/2.0		5/5/9	14			SM		BKG	0.4		
10	S-6 1.5/2.0		17/28/15	43			SM		BKG	0.4		
	S-7 1.5/1.5		17/23/15	43			SM		BKG	0.4		F
15	S-8 2.0/2.0		4/7/10/7	17			SM		BKG	1.2		L
20	S-9 2.0/2.0		3/7/10/10	17		20.0-21.0: Brown to gray Silty fine SAND; wet. 21.0-22.0: Dark green Clayey fine SAND; damp.	SC		BKG	0.8		
25	S-10		10/25/28/28	53		Dark green Clayey fine SAND; shell fragments; dense.	SC		BKG	BKG		
30	S-11		15/25/27/22	52		Light green Clayey fine SAND; trace medium Sand; shell fragments.	SC		BKG	BKG		
35	S-12		14/28/28/36	56		Similar to S-11.	SC	1	BKG	BKG		L
40						**BOTTOM OF EXPLORATION AT 37.0 FEET** NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS112

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 113.02
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/11/91	**Finish Date** 02/11/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 27.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 27.0	**Depth to Water (ft)-Date** 9.00 - 02/11/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.6/2.0		4/6/10/14	16		0.0-0.3: TOPSOIL 0.3-0.8: Brown Silty fine SAND.	SM		BKG	10.2		F
	S-2 1.5/2.0		10/12/15/18	27		0.8-1.1: Coal Ash. 1.1-1.6: Rust to olive-green Silty fine SAND; mottled.	SM		BKG	13.7		L
5	S-3 1.7/2.0		4/14/14/14	28		2.0-2.5: Black Coal Ash and gray fine SAND. 2.5-12.3: Light gray to green to brown to stained	SM		BKG	2.8		L
	S-4 1.4/2.0		4/7/8/10	15		black Silty fine SAND; some Silt laminae; wet below 9.0 feet.	SM		BKG	3.0		
	S-5 1.2/2.0		3/4/3/6	7			SM		BKG	1.0		
10	S-6 0.9/1.5		3/11/11	22			SM		BKG	1.2		
	S-7 1.5/1.5		24/33/34	67			SM		BKG	0.7		
	S-8 2.0/2.0		21/33/35/33	68		12.3-12.4: Black organic SILT. 12.4-15.0: Dark gray to black Silty fine SAND; some black Silt laminae; some fine to medium Sand laminae; wet.	SM		BKG	0.2		F L
15												
20	S-9 2.0/2.0		4/5/9/16	14		Similar to S-8.	SM		BKG	0.4		
25	S-10		4/6/12/18	18		Similar to S-8.	SM	1	BKG	0.4		F L
						BOTTOM OF EXPLORATION AT 27.0 FEET						
30						NOTES: 1. Boring backfilled with high solids bentonite grout.						
35												
40												

ABB ENVIRONMENTAL SERVICES, Inc.

08BS122

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 113.44
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/11/91	**Finish Date** 02/12/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 8.00 - 02/12/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.3/2.0		12/18/26/24	44		0.0-16.0: Tan to gray to black Silty fine SAND; layer black Coal Ash at 0.3 to 0.5 foot; layers Silt at 2.3 to 2.4 feet, 3.5 to 3.7 feet, and 10.3 to 10.7 feet.	SM		BKG	BKG		L
	S-2 1.7/2.0		21/27/27/31	54			SM		BKG	3.4		L F
5	S-3 1.2/2.0		8/12/18/22	30			SM		BKG	0.3		F
	S-4 1.7/2.0		17/18/71/21	89			SM		BKG	0.3		F
	S-5 1.5/1.5		15/12/15	27			SM		BKG	BKG		L
10	S-6 1.2/1.5		7/7/15	22			SM		BKG	BKG		F
	S-7 2.0/2.0		29/33/44/46	77			SM		BKG	BKG		F
	S-8 1.5/1.5		13/17/23	40			SM		BKG	BKG		F
15	S-9 1.5/1.5		29/33/47	80			SM		BKG	BKG		F
20	S-10 1.5/1.5		29/34/34	68		Dark gray Silty fine SAND; wet.	SM		BKG	BKG		F
25	S-11 2.0/2.0		12/14/10/8	34		Similar to S-10; medium to coarse Sand layer at 26.4 to 26.6 feet.	SM		BKG	BKG		
30	S-12 2.0/2.0		17/21/25/38	46		Dark green Clayey fine to medium SAND; fossilliferous; wet; dense.	SC		BKG	BKG		
35	S-13 2.0/2.0		19/22/30/30	52		Similar to S-12.	SC	1	BKG	BKG		L F
						BOTTOM OF EXPLORATION AT 37.0 FEET						
40						NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS123

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BBJ	**Checked By**	**Ground Elev** 113.35
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/10/91	**Finish Date** 01/11/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 12.00 - 01/10/91	**Piez** ☐ **Boring** ☒ **Well** ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.7/2.0		6/14/32/35	46		0.0-0.3: TOPSOIL.	SM		BKG	BKG		L
	S-2 2.0/2.0		22/26/29/33	55		0.3-10.5: Tan to rust to black stained Silty fine SAND; Sand laminae; Silt laminae; damp.	SM		BKG	BKG		
5	S-3 1.8/2.0		11/19/19/19	38			SM		BKG	BKG		
	S-4 1.8/2.0		11/30/39/20	69			SM		BKG	BKG		
	S-5 2.0/2.0		3/7/11/19	18					BKG	BKG		F L
10	S-6 2.0/2.0		15/18/25/30	43			SM		BKG	BKG		
	S-7 1.5/1.5		3/21/51	72		10.5-16.0: Layered brown Silty fine SAND and dark brown organic SILT; damp to wet.	OL		BKG	BKG		F L
15	S-8 2.0/2.0		15/15/20/25	35			SM		BKG	BKG		F
20	S-9 2.0/2.0		7/11/17/20	28		Dark brown Silty fine SAND; wet.	SM		BKG	BKG		F
25	S-10 2.0/2.0		4/3/5/4	8		25.0-25.9: Dark brown SILT; Sand laminae; dilatent; wet.	ML		BKG	BKG		
						25.9-27.0: Brown Silty fine SAND.	SM					
30	S-11 1.5/1.5		3/13/19	32		Gray Clayey SILT; firm.	ML		BKG	BKG		L
35	S-12 1.5/1.5		3/15/50	65		Blue-gray Silty fine SAND.	SM	1	BKG	BKG		F
						BOTTOM OF EXPLORATION AT 37.0 FEET						
40						NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS124

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BBJ	**Checked By**	**Ground Elev** 113.32
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/10/91	**Finish Date** 01/10/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 12.00 - 01/10/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC./RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 2.0/2.0		12/20/20/21	40		0.0-3.3: Rust colored fine SAND; little medium Sand; rootlets; heavy oil staining.	SP		BKG	30.0		L
	S-2 1.9/2.0		16/18/19/20	37			SM		2.0	30.0		L F
	S-3 1.8/2.0		9/17/19/10	36		3.3-11.3: Gray to rust Silty fine SAND; dry to moist.	SP		BKG	BKG		
5	S-4 2.0/2.0		17/19/24/24	43			SM		0.5	BKG		
	S-5 2.0/2.0		6/4/6/7	10			SM		BKG	BKG		
10	S-6 1.8/2.0		5/4/15/37	19			SM		BKG	BKG		
	S-7		20/24/74/55	98		11.3-16.0: Layers of gray Silty fine SAND and black organic SILT; moist to wet.	OL	1	BKG	BKG		L
15	S-8		11/26/20/17	46			SM OL		BKG	BKG		L F
20	S-9 2.0/2.0		6/9/11/3	20		Brown Silty fine SAND; wet.	SM		BKG	BKG		F
25	S-10 1.5/2.0		3/4/3/6	7		Similar to S-9.	SP		BKG	BKG		
30	S-11		1/4/6/20	10		Green to gray Clayey fine SAND; little medium Sand; wet.	SC		BKG	BKG		
35	S-12					Similar to S-11.	SC	2 3	BKG	BKG		
40						**BOTTOM OF EXPLORATION AT 37.0 FEET**						

NOTES:
1. Recovery/penetration not recorded for S-7, S-8, S-11, and S-12.
2. No blow counts recorded for S-12.
3. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS125

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BBJ/SJC	**Checked By**	**Ground Elev** 112.13
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/11/91	**Finish Date** 01/12/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 13.30 - 01/12/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 2.0/2.0		4/5/10/10	15		0.0-12.4: Gray to tan to rust Silty fine SAND; some medium and coarse Sand layers; trace thin Silt laminae; dry to moist.	SM		BKG	BKG		L
	S-2 1.8/2.0		9/9/11/19	20			SM-SP		BKG	BKG		
5	S-3 2.0/2.0		9/21/50/56	71			SP-SM		BKG	BKG		
	S-4 1.0/1.5		17/51/41	98			SM		BKG	BKG		L F
	S-5 1.5/1.5		3/9/17	26			SP-SM		BKG	BKG		
10	S-6 1.4/2.0		3/15/7/9	22			SM		BKG	BKG		
	S-7 2.0/2.0		7/18/33/35	51		12.4-16.0: Layered dark brown to gray Silty fine SAND and dark brown organic SILT; moist to wet.	SM		BKG	BKG		L
15	S-8 2.0/2.0		5/10/15/22	25			OL SM		BKG	BKG		
20	S-9 1.5/2.0		1/5/9/19	14		Dark brown to gray Silty fine SAND; wet.	SM		BKG	BKG		L F
25	S-10 1.8/2.0		5/10/10/15	20		Similar to S-9; thin laminae of medium Sand.	SM-SP		BKG	BKG		
30	S-11					Gray to green fossilliferous Clayey fine SAND; damp; dense.	SC	1	BKG	BKG		
35	S-12 1.8/2.0		10/38/38/25	66		Similar to S-11.	SC	2	BKG	BKG		
						BOTTOM OF EXPLORATION AT 37.0 FEET						
40						NOTES: 1. No blow counts or recovery recorded for S-11. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS126

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 112.10
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/12/91	**Finish Date** 01/13/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 9.00 - 01/13/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC./RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.3/2.0		9/17/28/21	45		0.0-1.0: TOPSOIL 1.0-8.0: Tan to brown Silty fine SAND; damp.	ML-SM		BKG	BKG		
	S-2 1.7/2.0		14/7/14/21	21			SP		BKG	BKG		
5	S-3 1.2/2.0		8/18/19/24	37			SM		BKG	BKG		
	S-4 1.7/2.0		12/25/29/32	54			SM		BKG	BKG		
	S-6 1.5/1.5		8/8/9	17		8.0-16.0: Tan to gray Silty fine SAND; organic Silt laminae and Clay laminae; roots and pine needles; damp to wet.	SM		BKG	BKG		
10	S-6 1.2/1.5		8/7/9	16			SM		BKG	BKG		L
	S-7 1.5/1.5		12/51/28	79			OL		0.3	BKG		F
15	S-8 1.5/1.5		4/40/20	60			SM		0.8	BKG		F
20	S-9		7/18/23/32	41		Dark gray to brown fine SAND; laminated; moist.	SP	1	1.5	BKG		
25	S-10		4/8/12/23	20		Dark brown Silty fine SAND; moist.	SM		0.8	BKG		F
30	S-11		5/9/10/15	19		Gray to green Clayey fine SAND; trace medium Sand; damp.	SC		0.3	BKG		
35	S-12 2.0/2.0		9/10/28/40	38		Similar to S-11.	SC	2	0.2	BKG		L
						BOTTOM OF EXPLORATION AT 37.0 FEET						
40						NOTES: 1. Recovery/penetration not recorded for S-9, S-10, S-11, and S-12. 2. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08BS127

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 111.61
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/13/91	**Finish Date** 01/13/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 14.00 - 01/13/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.2/2.0		8/10/22/30	32		TOPSOIL; Silty fine SAND.	SM		BKG	BKG		L
	S-2 1.6/2.0		22/26/36/37	62		2.0-12.2: Tan to orange to dark brown Silty fine SAND; Silt laminae; trace Gravel layers; Sand laminae; damp.	SP		BKG	BKG		L
5	S-3 1.5/2.0		8/19/18/20	37			SP-SM		BKG	BKG		F
	S-4 1.5/1.5		12/15/17	33			SM		BKG	BKG		
	S-5 1.5/1.5		8/11/21	32			SM		BKG	0.3		
10	S-6 1.5/1.5		7/15/21/30	36			SM-SP		BKG	BKG		
	S-7 1.5/1.5		8/11/19	30		12.2-16.0: Dark brown to gray Silty fine SAND; organic Silt layers.	SM OL		BKG	0.7		L F
15	S-8 2.0/2.0		20/35/27/31	62			SM		BKG	0.9		L F
20	S-9 2.0/2.0		3/5/11/15	16		Dark brown Silty fine SAND; wet.	SM		BKG	0.4		
25	S-10 2.0/2.0		5/5/5/5	10		Similar to S-9; little medium Sand.	SM		BKG	0.7		
30	S-11 2.0/2.0		5/9/9/15	18		Blue-green Clayey fine fossilliferous SAND; wet.	SC		BKG	1.0		
35	S-12 2.0/2.0		H/4/9/13	13		Similar to S-11.	SC	1	BKG	0.3		L
						BOTTOM OF EXPLORATION AT 37.0 FEET						
40						NOTES: 1. Boring backfilled with high solids bentonite grout.						

ABB ENVIRONMENTAL SERVICES, Inc.

08PZ101

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BCM	**Checked By**	**Ground Elev** 105.76
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** ATV	**Start Date** 01/13/91	**Finish Date** 01/13/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 15.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 15.0	**Depth to Water (ft)-Date** 4.11 - 05/30/91	**Piez. Boring Well** ☐ ☐ ☒

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
5						No samples taken - see 08PZ102 for soil descriptions.						
10												
15						BOTTOM OF EXPLORATION AT 15.0 FEET						
20												

ABB ENVIRONMENTAL SERVICES, Inc.

08PZ102

Project McGUIRE AIR FORCE BASE RI/FS			**Site** McGUIRE AFB	**Project** 6623-0
Client HAZWRAP			**Logged By** CFR / **Checked By**	**Ground** 105.42
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY		**Rig Type** ATV / **Start Date** 01/13/91	**Finish D** 01/13/
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D		**P.I.D. (eV)** 10.2 / **Casing Size** N/A	**Auger Si** 4.25"
Soil Drilled (ft) 57.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 57.0	**Depth to Water (ft)-Date** 4.30 - 05/30/91	**Piez.Boring** ☒ **We** ☐

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM
0	S-1 1.8/2.0		4/4/4/5	8		0.0-0.2: TOPSOIL 0.2-2.0: Gray Silty fine SAND; damp.	SM		BKG	BKG	
5	S-2 1.8/2.0		5/5/5/7	10		Similar to S-1 (0.2-2.0); wet.	SM		BKG	BKG	
10	S-3 1.5/2.0		3/4/10/9	14		Similar to S-2.	SM		BKG	BKG	
15	S-4 1.6/2.0		3/4/8/8	12		Similar to S-3.	SM		BKG	BKG	
20	S-5 2.0/2.0		4/7/10/30	17		20.0-21.5: Similar to S-3. 21.5-22.0: Green to gray Clayey fine SAND; fossilliferous; wet; dense.	SM SC		BKG	BKG	
25	S-6 2.0/2.0		8/18/28/30	46		Similar to S-5 (21.5-22.0).	SC		BKG	BKG	
30	S-7 2.0/2.0		5/20/30/30	50		Similar to S-5 (21.5-22.0).	SC		BKG	BKG	
35	S-8 2.0/2.0		10/15/19/25	34		Similar to S-5 (21.5-22.0).	SC		BKG	BKG	
40	S-9 2.0/2.0		4/10/12/26	22		Similar to S-5 (21.5-22.0).	SC		BKG	BKG	
45	S-10 1.5/2.0		3/5/13/15	18		Similar to S-5 (21.5-22.0).	SC		BKG	BKG	
50	S-11 1.5/2.0		6/25/30/36	55		Similar to S-5 (21.5-22.0); little cementation at 51.2 to 51.5 feet.	SC		BKG	BKG	
55	S-12 1.7/2.0		14/18/32/36	50		Similar to S-5 (21.5-22.0).	SC		BKG	BKG	
60						BOTTOM OF EXPLORATION AT 57.0 FEET					
65											
70											
75											

ABB ENVIRONMENTAL SERVICES, Inc.

08MW101

Project	Site	Project No.
McGUIRE AIR FORCE BASE RI/FS	McGUIRE AFB	6623-04

Client	Logged By	Checked By	Ground Elev
HAZWRAP	SJC		113.32

Drilling Contractor	Driller's Name	Rig Type	Start Date	Finish Date
MATHES OF NEW JERSEY	STEVE KOVALESKY	CME-75	02/21/91	02/22/91

Drilling Method	Protection Level	P.I.D. (eV)	Casing Size	Auger Size
Hollow Stem Auger	MOD. D	10.2	N/A	4.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez.	Boring	Well
22.0	N/A	22.0	9.72 - 05/30/91	☐	☐	☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC./RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 2.0/2.0		2/5/6/10	11		0.0-0.6: TOPSOIL	FILL		BKG	1.3		L
						0.6-1.2: Black Coal Ash.						
	S-2 2.0/2.0		5/5/6/10	11		1.2-2.2: Light Gray fine SAND; damp.	SP		BKG	BKG		
						2.2-5.0: Green to orange Silty fine SAND; mottled; damp.						
	S-3 2.0/2.0		5/10/10/10	20			SM		BKG	1.3		
5						5.0-8.8: Rust to tan SAND; well graded; moist.						
	S-4 2.0/2.0		5/6/6/8	12			SP		BKG	BKG		
	S-5 1.7/2.0		4/1/2/2	3			SP		BKG	1.1		
						8.8-9.1: Brown organic SILT; moist.	OL					
10	S-6 1.5/2.0		3/4/3/3	7		9.1-12.0: Rust to tan Silty fine SAND; mottled; trace medium Sand; moist to wet.	SM		BKG	1.1		F
	S-7 2.0/2.0		4/10/12/18	22		12.0-18.0: Tan to rust to black laminated Silty fine SAND; wet.	SM		BKG	BKG		F
15	S-8 1.0/2.0		5/5/2/5	7			SM		BKG	BKG		F
20	S-9 1.3/2.0		WOH/1/4/5	5		Similar to S-7.	SM		BKG	BKG		F
						BOTTOM OF EXPLORATION AT 22.0 FEET						
25												
30												
35												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW102

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 113.35
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** CME-75	**Start Date** 02/18/91	**Finish Date** 02/18/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 8.25"
Soil Drilled (ft) 25.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 25.0	**Depth to Water (ft)-Date** 10.71 - 05/30/91	**Piez. Boring Well** ☐ ☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC./RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 0.5/2.0		10/10/8/12	18		Brown fine SAND and TOPSOIL.	SP		BKG	20.0		
	S-2 1.5/2.0		13/15/15/13	30		2.0-10.0: Tan to brown to green Silty fine SAND; Sand laminae; black laminae; moist; fuel odor.	SM		BKG	47.2		F
5	S-3 2.0/2.0		2/6/7/10	13			SM		1.9	12.3		
	S-4 1.7/2.0		2/5/5/5	10			SM		BKG	12.2		
	S-5 1.3/2.0		4/3/4/3	7			SM		BKG	6.0		
10	S-6 1.8/2.0		1/2/1/4	3		10.0-10.8: Gray Silty fine SAND; brown Silt layers; moist; fuel odor.	SM		BKG	24.5		
	S-7 2.0/2.0		4/8/12/19	20		10.8-16.0: Gray to brown to black Silty fine SAND; wet; sulphor odor.	SM		BKG	2.2		F L
15	S-8 2.0/2.0		2/7/15/13	22			SM		BKG	5.3		L
20	S-9 2.0/2.0		1/1/5/9	6		Dark gray to black Silty fine SAND; brown Silt layers; wet.	SM		BKG	25.6		
	S-10 2.0/2.0		2/2/3/5	5		Dark brown fine SAND; some Silt; trace medium Sand; wet.	SP		BKG	1.6		
25						BOTTOM OF EXPLORATION AT 25.0 FEET						
30												
35												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW103

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 112.19
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/12/91	**Finish Date** 02/13/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 27.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 27.0	**Depth to Water (ft)-Date** 11.53 - 05/30/91	**Piez. Boring** ☐ **Well** ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 2.0/2.0		8/5/4/4	9		0.0-0.9: Tan fine SAND and TOPSOIL. 0.9-2.1: Coal Ash.	SP		BKG	BKG		
	S-2 2.0/2.0		13/13/19/21	32		2.1-8.0: Tan to brown to rust to olive-green Silty fine SAND; moist.	SM		BKG	BKG		
5	S-3 1.6/2.0		5/7/8/8	15			SM		BKG	BKG		
	S-4 1.2/2.0		4/4/4/4	8			SM		BKG	BKG		
	S-5 1.3/2.0		6/4/6/4	10		8.0-13.7: Black to olive-green SILT; mottled; some fine Sand; moist.	ML		BKG	0.3		
10	S-6 2.0/2.0		2/2/2/10	4			ML		BKG	BKG		
	S-7 1.5/2.0		6/11/14	25			ML		4.3	3.1		L
	S-8 1.0/1.5		9/10/11	21		13.7-15.0: Black medium to coarse SAND; some wood; strong fuel odor.	SW		26.4	140.7		F
20	S-9 2.0/2.0		9/10/11/11	21		Black Silty fine SAND; wet; strong fuel odor.	SM		271.0	337.0		F
25	S-10 2.0/2.0		4/4/5/4	9		Similar to S-9.	SM		197.0	311.0		F
						BOTTOM OF EXPLORATION AT 27.0 FEET						
30												
35												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW104

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Ele.** 112.05
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** CME-75	**Start Date** 02/20/91	**Finish Date** 02/20/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 8.25"
Soil Drilled (ft) 27.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 27.0	**Depth to Water (ft)-Date** 12.11 - 05/30/91	**Piez. Boring Well** ☐ ☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.7/2.0		3/3/7/10	10		Tan to green fine SAND and TOPSOIL.	SM		BKG	BKG		
	S-2 1.8/2.0		7/11/12/13	23		2.0-12.3: Tan to green to gray Silty fine SAND; trace medium Sand; some black fine Sand laminae; moist.	SM		BKG	BKG		F
5	S-3 2.0/2.0		4/7/5/8	12			SM		BKG	BKG		
	S-4 2.0/2.0		2/5/10/9	15			SM		BKG	BKG		F
	S-5 2.0/2.0		2/7/7/8	14			SM		BKG	BKG		
10	S-6 1.9/2.0		1/1/2/3	3			SM		BKG	BKG		F
	S-7 2.0/2.0		1/8/3/8	11		12.3-16.0: Layered black organic SILT; wood fragments; gray Silty SAND; well graded; damp to wet.	OL		BKG	BKG		F
15	S-8 2.0/2.0		12/8/10/3	18			SM		BKG	BKG		F L
20	S-9 1.1/2.0		WOH/1/2/8	3		Dark gray Silty fine SAND; wet.	SM		BKG	BKG		F
25	S-10 1.7/2.0		1/1/3/5	4		Dark Gray well-graded SAND, trace fine Gravel; wet.	SP		BKG	BKG		F
						BOTTOM OF EXPLORATION AT 27.0 FEET						
30												
35												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW105

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC/AMB	**Checked By**	**Ground Elev** 109.41
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** CME-75	**Start Date** 02/19/91	**Finish Date** 02/19/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 8.25"
Soil Drilled (ft) 22.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 22.0	**Depth to Water (ft)-Date** 9.03 - 05/30/91	**Piez** ☐ **Boring** ☐ **Well** ☒

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.0/2.0		10/6/6/9	12		0.0-0.3: TOPSOIL 0.3-0.8: Coal Ash. 0.8-11.5: Tan to green Silty fine SAND; trace Gravel; black fine Sand laminae; wet below 9.0 feet.	SM		BKG	10.2		
	S-2 1.6/2.0		10/13/19/15	32			SM		2.2	19.8		
5	S-3 1.9/2.0		4/6/8/11	14			SM		10.0	137.0		F
	S-4 2.0/2.0		1/3/7/9	10			SM		5.5	68.7		F
	S-5 2.0/2.0		3/4/4/2	8			SM		10.0	147.0		F
10	S-6 2.0/2.0		1/2/2/2	4			SM		0.3	57.5		F
	S-7 2.0/2.0		1/2/2/1	4		11.5-16.0: Brown organic SILT; some brown fine Sand; wet.	OL		BKG	4.8		
15	S-8 2.0/2.0		1/2/2/1	4			OL		BKG	3.8		
	S-9 1.2/2.0		1/2/4/5	6		Gray fine SAND; some coarse Sand; trace Gravel; wet.	SP		BKG	BKG		F
20	S-10 1.6/2.0		2/5/3/6	8		Similar to S-9.	SP		10.0	26.0		L F
25						BOTTOM OF EXPLORATION AT 22.0 FEET						
30												
35												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW106

Project	Site	Project No.
McGUIRE AIR FORCE BASE RI/FS	McGUIRE AFB	6623-04

Client	Logged By	Checked By	Ground Elev
HAZWRAP	SJC		108.22

Drilling Contractor	Driller's Name	Rig Type	Start Date	Finish Date
MATHES OF NEW JERSEY	STEVE KOVALESKY	CME-75	02/19/91	02/20/91

Drilling Method	Protection Level	P.I.D. (eV)	Casing Size	Auger Size
Hollow Stem Auger	MOD. D	10.2	N/A	8.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez.	Boring	Well
27.0	N/A	27.0	8.54 - 05/30/91	☐	☐	☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.2/2.0		2/2/4/5	6		Tan fine SAND and TOPSOIL.	SM		BKG	BKG		
	S-2 2.0/2.0		5/6/9/9	15		2.0-12.4: Green to black fine SAND; little Silt; little medium Sand; trace wood; black Sand laminae; fuel odor.	SP		BKG	BKG		F
5	S-3 1.8/2.0		4/5/6/10	11			SP		BKG	BKG		F
	S-4 1.8/2.0		3/6/5/4	11			SP		BKG	5.5		F
	S-5 0.2/2.0		WOH				SP		BKG	BKG		F
10	S-6 1.7/2.0		WOH/WOH 1/1	1			SP		BKG	23.8		F L
	S-7 1.7/2.0		WOH/WOH 2/2	2		12.4-13.6: Black organic SILT; wood fragments.	SP OL		BKG	BKG		F
15	S-8 2.0/2.0		WOH/2/3/5	5		13.6-16.0: Tan to dark brown Silty fine SAND; some roots; damp.	SM		BKG	3.8		F
20	S-9 1.3/2.0		2/6/3/7	9		Gray fine to medium SAND; wet.	SP		BKG	19.8		F
25	S-10 1.8/2.0		WOR/1/2/3	3		25.0-25.4: Tan fine SAND; little medium Sand; little Silt; wet.	SP SC		BKG	BKG		F
						~~25.4-26.0: Green fine to medium Clayey SAND; trace fossil fragments; tan fine Sand laminae; wet.~~						
						BOTTOM OF EXPLORATION AT 27.0 FEET						
30												
35												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW107

Project	Site	Project No.
McGUIRE AIR FORCE BASE RI/FS	McGUIRE AFB	6623-04

Client	Logged By	Checked By	Ground Elev
HAZWRAP	CFR		103.60

Drilling Contractor	Driller's Name	Rig Type	Start Date	Finish Date
MATHES OF NEW JERSEY	STEVE KOVALESKY	ATV	01/14/91	01/14/91

Drilling Method	Protection Level	P.I.D. (eV)	Casing Size	Auger Size
Hollow Stem Auger	MOD. D	10.2	N/A	4.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez.	Boring	Well
57.0	N/A	57.0	9.45 - 05/30/91	☐	☐	☒

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.8/2.0		4/5/20/22	25		0.0-0.4: TOPSOIL 0.4-2.0: Brown to gray Silty fine SAND; damp.	SM		BKG	BKG		
5	S-2 1.5/1.5		8/12/18	30		Tan to gray Silty fine SAND; trace wood fragments; damp.	SM		BKG	0.3		
10	S-3 1.5/1.5		5/5/8	13		Gray to dark gray Silty fine SAND; little Clay; Silt laminae; damp.	SM		BKG	BKG		
15	S-4 1.5/1.5		4/5/8	13		Similar to S-3; wet.	SM		BKG	BKG		F
20	S-5 1.8/2.0		4/4/6/8	10		Similar to S-4.	SM		BKG	BKG		
25	S-6 2.0/2.0		3/6/8/13	14		Dark gray fine to medium SAND; trace Silt; wet.	SP		BKG	BKG		
30	S-7 2.0/2.0		6/10/14/20	24		30.0-30.2: Similar to S-6. 30.2-32.0: Green fine to medium Clayey SAND; fossil fragments; wet.	SP SC		BKG	BKG		
35	S-8 2.0/2.0		8/12/21/28	33		Similar to S-7 (30.2-32.0).	SC		BKG	BKG		
40	S-9 2.0/2.0		4/10/20/55	30		Similar to S-7 (30.2-32.0).	SC		BKG	BKG		
45	S-10 2.0/2.0		15/25/25/40	50		Similar to S-7 (30.2-32.0).	SC		BKG	BKG		
50	S-11 2.0/2.0		8/20/30/30	50		Similar to S-7 (30.2-32.0).	SC		BKG	BKG		
55	S-12 2.0/2.0		2/4/16/3	20		55.0-55.6: Similar to S-7 (30.2-32.0). 55.6-57.0: Dark gray fine to medium Clayey SAND; fossilliferous; wet.	SC		BKG	BKG		L
60						BOTTOM OF EXPLORATION AT 57.0 FEET						

ABB ENVIRONMENTAL SERVICES, Inc.

08MW108

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No** 6623-04
Client HAZWRAP		**Logged By** LNT	**Checked By**	**Ground Elev** 103.34
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** ATV	**Start Date** 01/23/91	**Finish Date** 01/23/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD: D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 25.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 25.0	**Depth to Water (ft)-Date** 7.06 - 05/30/91	**Piez. Boring Well** ☐ ☐ ☒

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
						See 08-MW-107 for complete soil descriptions.						
15	S-1 1.9/2.0		6/6/12/11	18		Dark brown fine Silty SAND.	SM		BKG	BKG		L
25						BOTTOM OF EXPLORATION AT 25.0 FEET						

ABB ENVIRONMENTAL SERVICES, Inc.

08MW109

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BBJ	**Checked By**	**Ground Elev** 101.92
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** ATV	**Start Date** 01/23/91	**Finish Date** 01/24/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 22.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 22.0	**Depth to Water (ft)–Date** 10.92 - 05/30/91	**Piez.** ☐ **Boring** ☐ **Well** ☒

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 0.5/2.0		WOH/6/16/10	22		Brown SILT and TOPSOIL.	OL		BKG	BKG		L
5	S-2 1.5/1.5		9/11/17	28		Brown SILT; some fine Sand; some medium to coarse Sand; some wood fragments; moist.	OL		BKG	0.3		
10	S-3 1.5/1.5		10/9/11	20		Brown Silty fine SAND; some coarse Sand layers; trace wood fragments; wet.	SM		BKG	BKG		L
15	S-4 2.0/2.0		3/10/10/10	20		Similar to S-3.	SM		BKG	0.5		
20	S-5 2.0/2.0		3/5/7/4	12		20.0-21.8: Similar to S-3.	SM		BKG	0.5		F
						21.8-22.0: Green to black Clayey fine SAND.	SC					
						BOTTOM OF EXPLORATION AT 22.0 FEET						
25												

ABB ENVIRONMENTAL SERVICES, Inc.

08MW110

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** BCM	**Checked By**	**Ground Elev** 112.34
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** STEVE KOVALESKY	**Rig Type** CME-75	**Start Date** 02/12/91	**Finish Date** 02/13/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 8.25"
Soil Drilled (ft) 26.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 26.0	**Depth to Water (ft)-Date** 9.80 - 05/30/91	**Piez. Boring Well** ☐ ☐ ☒

DEPTH(FEET)	SAMPLE NO. & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.6/2.0		4/4/5/6	9		0.0-0.7: Tan fine SAND and TOPSOIL. 0.7-2.0: Coal Ash.	SP		BKG	302		F
	S-2 1.5/2.0		6/8/10/15	18		2.0-8.0: Brown to gray fine SAND; black stained layers; moist; fuel odor.	SP		327	197		F
5	S-3 1.5/2.0		2/7/8/8	15			SP		652	272		L F
	S-4 1.2/2.0		10/25/45/15	70			SP		227	214		F
	S-5 1.5/2.0		2/3/2/5	5		8.0-11.0: Olive Silty fine SAND; wood fragments.	SM		548	217		F
10	S-6 1.7/2.0		2/2/5/8	7			SM		554	268		L F
	S-7 1.2/2.0		3/6/4/1	10		11.0-15.5: Olive to gray Silty fine SAND; trace coarse Sand and Gravel; moist; loose.	SM		609	301		F
15	S-8 1.5/1.5		1/3/9	12			SM		10	74		F
			1/3/5/5	8		Dark gray Silty fine SAND; wet; loose.	SM					
20	S-9 1.3/2.0								1.5	235		
			WOH/2/3/6	5		Similar to S-9.	SP-SM					F
25	S-10								2.2	30		
						BOTTOM OF EXPLORATION AT 26.0 FEET						

APPENDIX B

AIR PERMIT FOR OPERATION OF THE BIOSLURPER PILOT TEST AT THE BFSA, MCGUIRE AFB, NJ

cc: BNSR File
Regional Office

ATTACHMENT TO AIR POLLUTION CONTROL PERMIT
TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS
OR EQUIPMENT AND CERTIFICATE TO OPERATE CONTROL
APPARATUS OR EQUIPMENT
FOR

Applicant: McGuire Air Force Base
Location: Bulk Fuel Storage Area (BFSA)
West Arnold Avenue
McGuire AFB, Burlington County
BNSR Log Number: 01-95-4474
Stack Designation: Bioslurping Field Test

1. This equipment shall not cause any air contaminant, including an air contaminant detectable by the sense of smell, to be present in the outdoor atmosphere in such quantity and duration which is, or tends to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property, except in areas over which the owner or operator has exclusive use or occupancy.

2. All volatile organic compounds (VOC, as defined by N.J.A.C. 7:27-16.1) and toxic substances (TXS, as defined by N.J.A.C. 7:27-17.1) emissions from the vapor extraction point shall be directed through the control device as presented in the application.

3. Both VOC and TXS shall be monitored to ensure proper operation of the control device. Any thermal oxidizer, catalytic oxidizer, or internal combustion engine utilized shall not operate at less than the temperature as specified on the application and not less than manufacturer's specifications. Any carbon adsorption unit utilized shall be monitored to ensure that breakthrough from the final canister has not occurred. If breakthrough of the final carbon unit is detected, the carbon shall be replaced or the pilot test shall be terminated immediately.

4. The operation shall cease if total VOC emissions exceed 0.5 pounds per hour or TXS emissions exceed 0.1 pounds per hour.

5. This approval shall be used for the purposes of an "Environmental Improvement Pilot Test" as defined in N.J.A.C. 7:27-8.2. The length of the pilot test shall not exceed the time listed in the application.

6. The results of the monitoring, as described in the application, shall be recorded. These results must be kept by the applicant for a minimum of 5 years. A summary of these results and the BNSR log number as referenced above must be submitted with any subsequent air permit application for this soil remediation project.

7. The applicable Regional Field Office, shall be notified at least 72-hours prior to the actual testing in order that representatives of these offices may be scheduled to observe the conduct of the tests.

8. The Department issues this permit on the basis of the equipment descriptions and operating procedures presented in the Application. If the final design and operation of the equipment differ from those presented, this Permit approval is invalid.

9. As a condition of this Permit, the Applicant shall comply with all terms and conditions of any Administrative Consent Order related to this Permit.

10. The approval of this pilot test shall not be considered as Departmental acceptance of the proposed process for remediation purposes. Permits and certificates issued under N.J.A.C. 7:27-8 are based on emissions of air contaminants only and do not in any way relieve the Applicant from the obligation to obtain necessary permits from other governmental agencies.

State of New Jersey
Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

October 12, 1995

King Mak
McGuire Air Force Base
305 SPTG/CEV, 3400 Broidy Rd.
McGuire AFB, NJ 08641-5303

Plant Location: McGuire AFB
County: Burlington
Applicant's Designation of Stack: Bioslurping Field Test
Application Log #: 01954474
Approval Date: 10/10/95
Approval Status Code: 51

PERMIT TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS OR EQUIPMENT

This permit is being issued under the authority of chapter 106, P.L. 1967 (N.J.S.A. 26:2C-9.2). You may construct, install, or alter the control apparatus or equipment as indicated on the application referenced above.

The Status of this approval is referenced above. Please see page 2 of this letter for the explanation of the status code.

The duration of this permit is explained in the conditions attached to this document.

If you have any questions regarding this document, please write to the Bureau of New Source Review at the above address. Questions regarding Certificates to Operate should be directed to the Regional Office.

Approved by: _____
Chief

cc: BNSR File
Regional Office

VEM-045 (2/95)

NJ DEP REGIONAL OFFICES

METROPOLITAN REGIONAL ENFORCEMENT
Bureau of Enforcement Operations
2 Babcock Place
West Orange, New Jersey 07052
(201) 669-3935

Covers Counties of: Bergen, Essex, Hudson & Union

CENTRAL REGIONAL ENFORCEMENT
Bureau of Enforcement Operations
Rte. 130, Horizon Center, Bldg. 300
Robbinsville, New Jersey
Mailing Address: CN 407, Trenton, NJ 08625-0407
(609) 584-4100

Covers Counties of: Burlington, Mercer, Middlesex, Monmouth & Ocean

NORTHERN REGIONAL ENFORCEMENT
Bureau of Enforcement Operations
1259 Route 46
Parsippany-Troy Hills, N.J. 07054
(201) 299-7700

Covers Counties of: Hunterdon, Morris, Somerset, Sussex, Passaic & Warren

SOUTHERN REGIONAL ENFORCEMENT
Bureau of Enforcement Operations
The Paint Works Corporate Center
20 East Clementon Road/3rd Floor
Gibbsboro, N.J. 08026
(609) 346-8071

Covers Counties of: Atlantic, Camden, Cape May, Cumberland, Salem & Gloucester

NJ DEP - MINOR SOURCE COMPLIANCE
Rte. 130, Horizon Center, Bldg. 300
Robbinsville, New Jersey
Mailing Address: CN 407, Trenton, NJ 08625-0407
(609) 584-4240

Covers all counties statewide.

CERTIFICATE STATUS CODES:

01	-	Temporary Operating Certificate
05	-	Five Year Operating Certificate
51	-	Conditional — Temporary (See Condition Checked)
55	-	Five Year Conditional (See Condition Checked)

ALL PERMIT AND CERTIFICATE APPROVALS ARE SUBJECT TO THE PROVISION THAT:
This equipment shall not cause any air contaminant, including an air contaminant detectable by the sense of smell, to be present in the outdoor atmosphere in such quantity and duration which is, or tends to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property, except in areas over which the owner or operator has exclusive use or occupancy.

CONDITIONS THAT WILL APPLY:

____ No visible emissions, exclusive of condensed water vapor.
____ No person shall cause, suffer, allow or permit particles to be emitted from this stack or chimney into the outdoor air, the shade or appearance of which is greater than 10% opacity, exclusive of visible condensed water vapor.
✓ Special conditions (see attached)

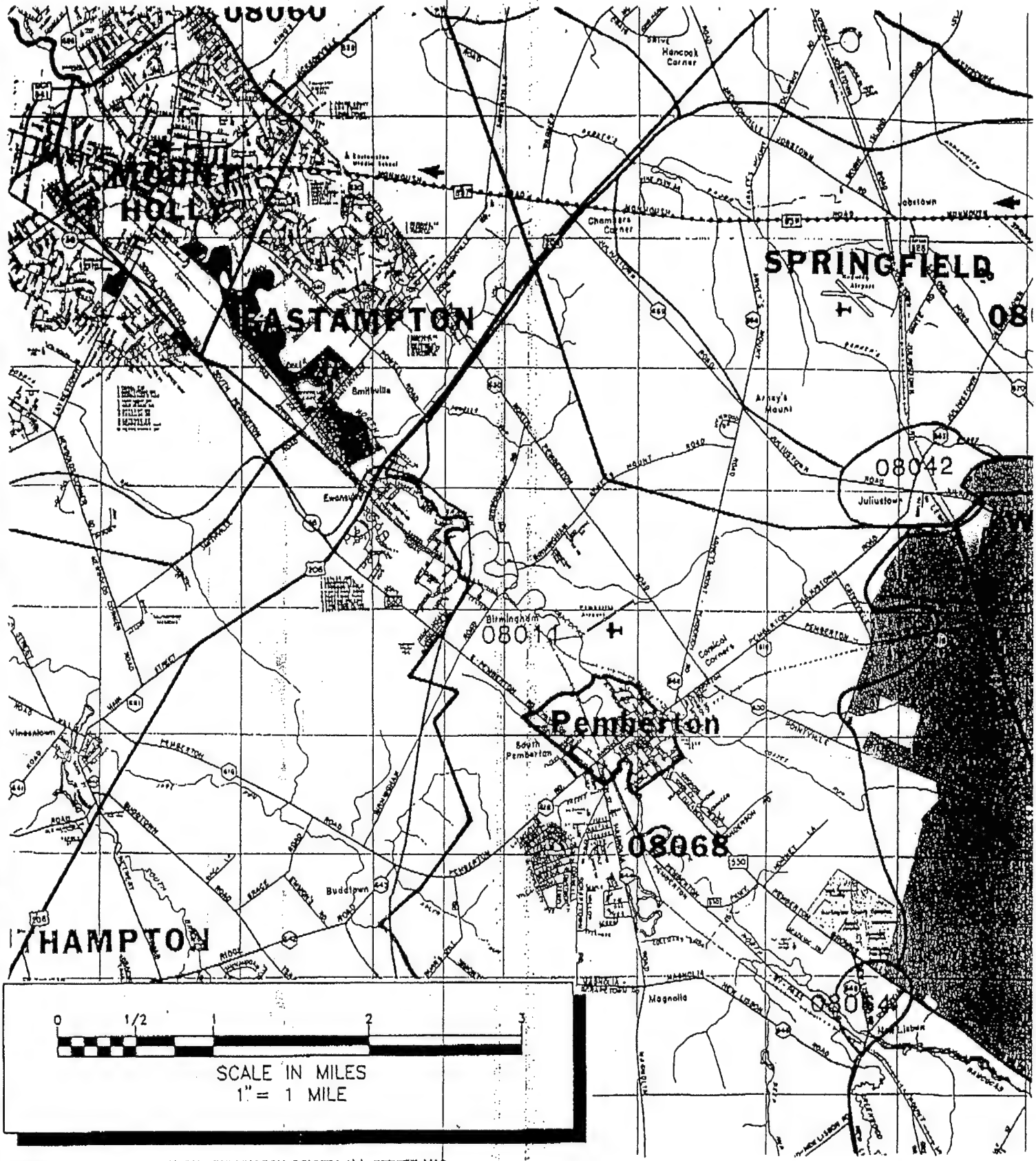
NOTE:

____ **If this item is checked this Operating Certificate is not approved for start up.**

APPENDIX C

MAP SHOWING LOCATION OF BURLINGTON COUNTY HOSPITAL

AFCEE-17/15FEB95/U4



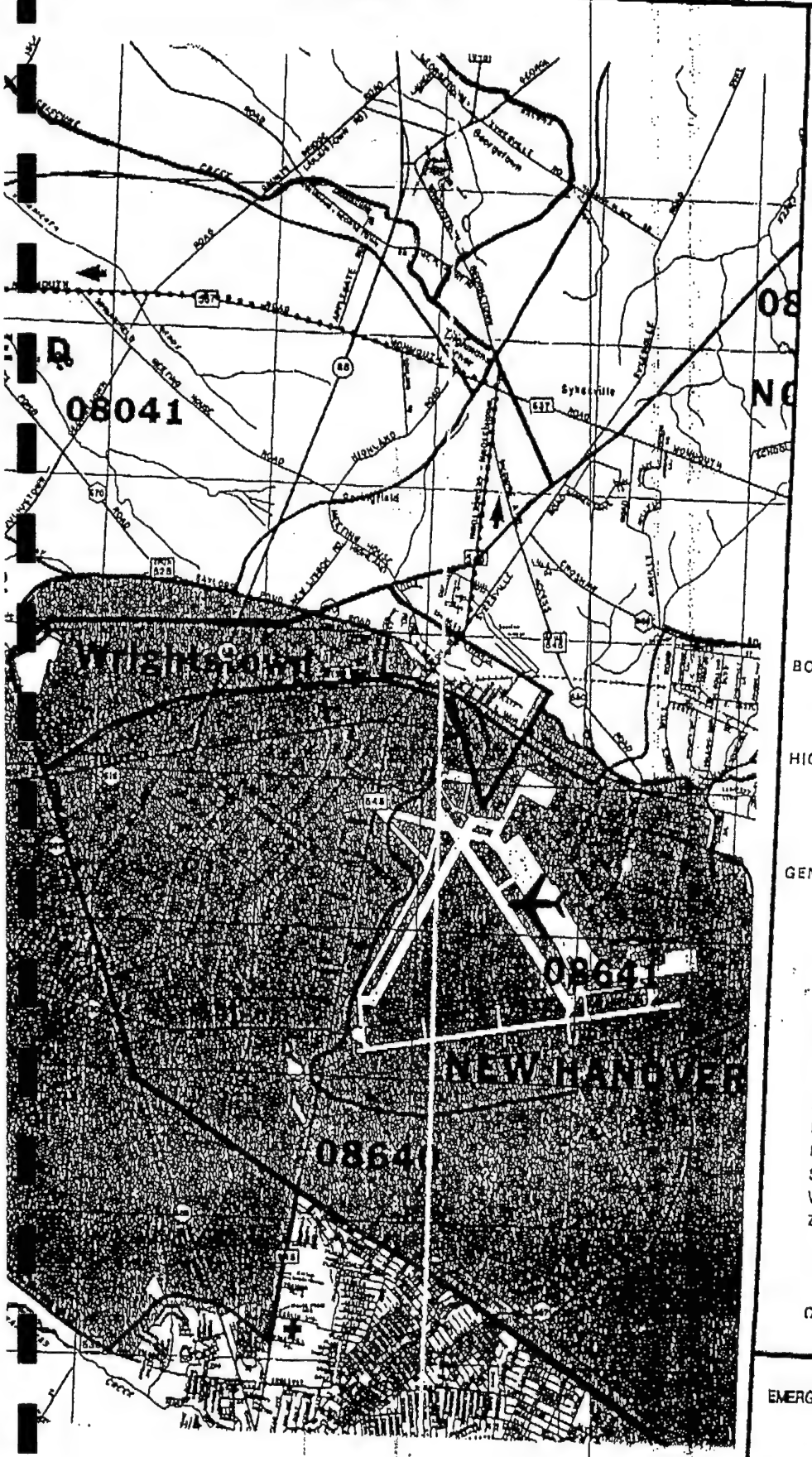
SOURCE: ALFRED B. PATTON, INC.; BURLINGTON COUNTY, N.J., STREET MAP

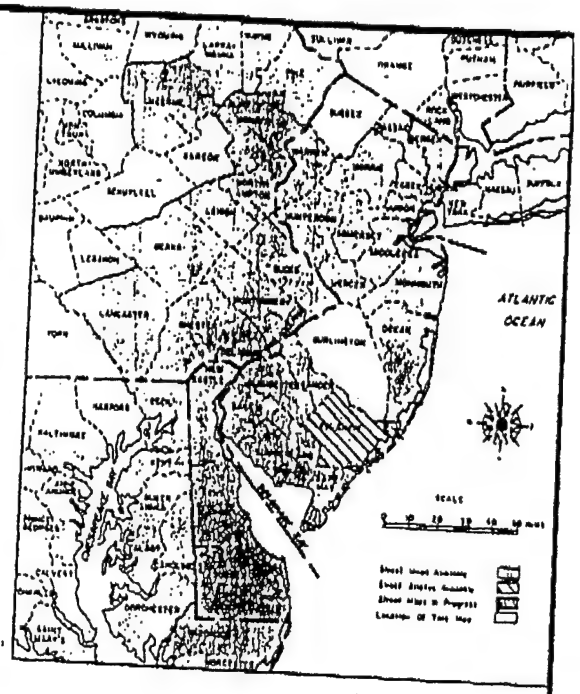
HQ/AFCEE/ERD

ROUTE TO HOSPITAL MAP - BURLIN

MCGUIRE AFB - INSTALLATION F

SCORING DOCU





LEGEND:

BOUNDARIES:
- STATE LINE
- COUNTY LINE
- TOWNSHIP & BOROUGH LINE

HIGHWAY MARKERS:
- INTERSTATE ROUTE 75
- U.S. ROUTE 13
- STATE ROUTE 70
- COUNTY ROUTE 528 641

GENERAL & CULTURAL FEATURES:
- STATE PARK
- COUNTY & MUNICIPAL PARK
- AIRPORT
- BATONA TRAIL (Approximate Location)
- CEMETERY
- CITY — BOROUGH
- GOLF COURSE — COUNTRY CLUB
- GOVERNMENT FACILITY
- HOSPITAL — MEDICAL CENTER
- INDUSTRIAL PARK
- MILITARY RESERVATION
- SHOPPING CENTER
- STATE FOREST
- WILDLIFE MANAGEMENT AREA

ZIP CODES:
- BOUNDRY LINE
- DELIVERY 08010
- NON-DELIVERY 08048

COUNTY COURTHOUSE

EMERGENCY ROUTE TO HOSPITAL

URLINGTON COUNTY HOSPITAL
ON RESTORATION PROGRAM

APPENDIX B

LABORATORY ANALYTICAL REPORTS

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
FAX: 702-355-0406
1-800-283-1183

Boise, Idaho
(208) 336-4145

2505 Chandler Avenue, Suite 1
Las Vegas, Nevada 89120
(702) 498-3312
FAX: 702-736-7523
1-800-283-1183

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#: G462201-30D0201
Phone: (614) 424-6122
Attn: Al Pollack

Alpha Analytical Number: BMI111795-01

Client I.D. Number: MG-F-1

Date Sampled: 11/12/95

Date Received: 11/17/95

Compound	Method	Concentration ug/Kg	Detection Limit ug/Kg	Date Analyzed
Benzene	8240	1,600,000	360,000	10/22/95
Toluene	8240	13,000,000	360,000	10/22/95
Total Xylenes	8240	18,000,000	360,000	10/22/95
Ethylbenene	8240	2,900,000	360,000	10/22/95
C-range Compounds	Method	Percentage of Total	Detection Limit (Not Applicable)	Date Analyzed
C07<	GC/FID	26.4	NA	11/20/95
C08	GC/FID	13.2	NA	11/20/95
C09	GC/FID	10.8	NA	11/20/95
C10	GC/FID	8.8	NA	11/20/95
C11	GC/FID	9.5	NA	11/20/95
C12	GC/FID	10.9	NA	11/20/95
C13	GC/FID	10.0	NA	11/20/95
C14	GC/FID	6.3	NA	11/20/95
C15>	GC/FID	4.1	NA	11/20/95

Approved by: Roger L. Scholl Date: 11/30/95

Roger L. Scholl, Ph.D.
Laboratory Director

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
FAX: 702-355-0406
1-800-283-1183

Boise, Idaho
(208) 336-4145

Las Vegas, Nevada
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6199
Attn:

Sampled: 11/10/95 Received: 11/17/95 Analyzed: 11/22/95

Matrix: [X] Soil [ ] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Purgeable Quantitated As Gasoline
BTXE - Benzene,Toluene,Xylenes,Ethylbenzene

Methodology: TPH - Modified 8015/DHS LUFT Manual/BLS-191
BTXE - Method 624/8240

Results:

Client ID/ Lab ID	Parameter	Concentration	Detection Limit	
MG-S-1	TPH (Purgeable)	58	10	mg/Kg
/BMI111795-02	Benzene	120	20	ug/Kg
	Toluene	290	20	ug/Kg
	Total Xylenes	1,900	20	ug/Kg
	Ethylbenzene	300	20	ug/Kg
MG-S-2	TPH (Purgeable)	ND	10	mg/Kg
/BMI111795-03	Benzene	33	20	ug/Kg
	Toluene	61	20	ug/Kg
	Total Xylenes	390	20	ug/Kg
	Ethylbenzene	61	20	ug/Kg
MG-S-3	TPH (Purgeable)	360	200	mg/Kg
/BMI111795-04	Benzene	ND	400	ug/Kg
	Toluene	1,200	400	ug/Kg
	Total Xylenes	10,000	400	ug/Kg
	Ethylbenzene	1,600	400	ug/Kg

ND - Not Detected

Approved by: Roger L. Scholl Date: 11/30/95
Roger L. Scholl, Ph.D.
Laboratory Director

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
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Boise, Idaho
(208) 336-4145

Las Vegas, Nevada
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6199
Attn:

Sampled: 11/16/95 Received: 11/17/95 Analyzed: 11/22/95

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Purgeable Quantitated As Gasoline
BTXE - Benzene,Toluene,Xylenes,Ethylbenzene

Methodology: TPH - Modified 8015/DHS LUFT Manual/BLS-191
BTXE - Method 624/8240

Results:

Client ID/ Lab ID	Parameter	Concentration	Detection Limit
MG-OWS-1	TPH (Purgeable)	47	25 mg/L
/BMI111795-05	Benzene	4,000	50 ug/L
	Toluene	9,400	50 ug/L
	Total Xylenes	6,700	50 ug/L
	Ethylbenzene	1,100	50 ug/L
MG-Discharge-1	TPH (Purgeable)	38	25 mg/L
/BMI111795-06	Benzene	3,600	50 ug/L
	Toluene	8,600	50 ug/L
	Total Xylenes	6,100	50 ug/L
	Ethylbenzene	1,000	50 ug/L

ND - Not Detected

Approved by: Roger L. Scholl Date: 11/30/95
Roger L. Scholl, Ph.D.
Laboratory Director

Laboratory Analysis Report

Sierra Environmental Monitoring, Inc.

ALPHA ANALYTICAL
255 GLENDALE AVENUE, SUITE 21
SPARKS NV 89431

Date : 12/05/95
Client : ALP-855
Taken by: CLIENT
Report : 14971
PO# :

Sample	Collected Date	Time	MOISTURE CONTENT %	DENSITY G/CM3	POROSITY %	PARTICLE SIZE DISTIBUTION		
BMI111795-02 - MG-S-1	11/10/95	:	21.7	1.21	54.3	78/15/7 *		
BMI111795-03 - MG-S-2	11/10/95	:	24.5	1.36	48.7	88/5/7 *		
BMI111795-04 - MG-S-3	11/10/95	:	26.1	1.29	51.3	82/10/8 *		

Approved By: _____

William F. Pillsbury
President

1135 Financial Blvd.
Reno, NV 89502
Phone (702) 857-2400
FAX (702) 857-2404

John C. Seher
Manager

Laboratory Analysis Report

Sierra Environmental Monitoring, Inc.

ALPHA ANALYTICAL
255 GLENDALE AVENUE, SUITE 21
SPARKS NV 89431

Date :
Client : ALP-855
Taken by: CLIENT
Report : 14971
PO# :

* PERCENT SAND / SILT / CLAY

1135 Financial Blvd.
Reno, NV 89502
Phone (702) 857-2400
FAX (702) 857-2404

William F. Pillsbury
President

John C. Seher
Manager

Sierra
Environmental
Monitoring, Inc.

December 4, 1995

TO: **Alpha Analytical**

FROM: Sierra Environmental Monitoring, Inc.

RE: Particle Size Distribution Analysis for Samples:

SEM 9511-0501	AAI	BMI111795-02	MG-S-1
SEM 9511-0502	AAI	BMI111795-03	MG-S-2
SEM 9511-0503	AAI	BMI111795-04	MG-S-3

As per your request, we have performed particle size analysis on the samples submitted to our laboratory. Test results are as follows:

	BMI111795-01	BMI111795-02	BMI111795-03
% Sand	78	88	82
% Silt	15	5	10
% Clay	7	7	8

The sample was passed through a #10 sieve prior to analysis as per procedure. All results are based on oven dry sample weights.

We appreciate this opportunity to provide our laboratory testing services. If you have any questions or require further testing, please feel free to contact us at your convenience.

Sincerely,
SIERRA ENVIRONMENTAL MONITORING, INC.

John Seher
Laboratory Manager

1135 Financial Blvd.
Reno, NV 89502
Phone (702) 857-2400
FAX (702) 857-2404

William F. Pillsbury
President

John C. Seher
Manager

Battelle
Columbus Laboratories

CHAIN OF CUSTODY RECORD

Form No. ______

Proj. No.	Project Title
646201-30A0401	Bioslurper, McGuire AFB

SAMPLERS: (Signature) [signature]

DATE	TIME	SAMPLE I.D.	TPH as JP-4	BTEX	Boiling Point Distribution	Porosity	Moisture Content	Bulk Density	Particle Size Distribution	Container No.	Number of Containers	Remarks
11/12/95	1400	MG-F-1		X	X						1	
11/10/95	1400	MG-S-1	X	X		X	X	X	X		1	
11/10/95	1415	MG-S-2	X	X		X	X	X	X		1	
11/10/95	1430	MG-S-3	X	X		X	X	X	X		1	
11/16/95	1030	MG-OWS-1	X	X							3	
11/16/95	1030	MG-Discharge-1	X	X							3	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	11/16/95				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks
		[signature]	11/17/95 1015	

Page ____ of ____

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
Phone (702) 355-1044
Fax (702) 355-0406

Billing Information:
Name
Address
City, State, Zip
Phone Number

Page # 1 of 1

Client Name: Battelle	P.O. #
Address	Phone #
City, State, Zip	Report Attention
Sampled by: Client	

Analyses Required

Time Sampled	Date Sampled	Type* See Key Below	Lab ID Number	Sample Description	Number of Containers	TPH/Gas	BTXE	Hydraulic Distribution	Porosity	Moisture Content	Bulk Density	Particle Size Dist.			Remarks
	11/12	OT	BMI111795-01	MG-F-1	(CAN)		X	X							[illegible]
	11/10	SO	02	MG-S-1	1	X	X		X	X	X	X			Mesquite AFB
	✓	✓	03	MG-S-2	1	X	X		X	X	X	X			
	✓	✓	04	MG-S-3	1	X	X		X	X	X	X			
	11/16	AQ	05	MG-OWS-1	3	X	X								
	✓	✓	06	MG-Discharge-1	3	X	X								

	Signature	Print Name	Company	Date	Time
Relinquished by					
Received by	[signature]	Linda Bydlazek	AHI	11/17/95	1150
Relinquished by	[signature]	Darin Hussey	AAI	11/20/95	1:35 pm
Received by	[signature]	[signature]	SEM	11/20/95	1335
Relinquished by					
Received by					

NOTE: Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9511170

Work Order Summary

CLIENT:	Mr. Eric Dreschler Battelle Memorial Institute 505 King Avenue Columbus, OH 43201	**BILL TO:** Same	
PHONE:	614-424-3753	**INVOICE #** 8850	
FAX:	614-424-3667	**P.O. #**	
DATE RECEIVED:	11/17/95	**PROJECT #** G462201-30A0401 Bioslurper	
DATE COMPLETED:	11/30/95	**AMOUNT$:** $810.49	

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	MG-LRP Resovoir-1	TO-3	0.2 psi	$120.00
02A	MG-LRP Resovoir-2	TO-3	0.2 psi	$120.00
03A	MG-LRP Stack-1	TO-3	0 "Hg	$120.00
04A	MG-LRP Stack-2	TO-3	0.2 psi	$120.00
05A	MG-ICE Stack-1	TO-3	0.5 "Hg	$120.00
06A	MG-ICE Stack-2	TO-3	0.5 "Hg	$120.00
07A	Lab Blank	TO-3	NA	NC
Misc. Charges	1 Liter Summa Canister Preparation (6) @ $10.00 each.			$60.00
	Shipping (11/7/95)			$30.49

CERTIFIED BY: Robert Kooima

Laboratory Director

DATE: 11/30/95

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA 95630
(916) 985-1000 • (800) 985-5955 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: MG-LRP Resovoir-1

ID#: 9511170-01A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112706**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2000**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	2.0	6.5	47	150
Toluene	2.0	7.7	460	1800
Ethyl Benzene	2.0	8.8	25	110
Total Xylenes	2.0	8.8	78	340

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	**6112706**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2000**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	20	130	70000	450000
C2 - C4** Hydrocarbons	20	37	10000	18000

*TPH referenced to Jet Fuel (MW=156)

**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: MG-LRP Resovoir-2
ID#: 9511170-02A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112707**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2000**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	2.0	6.5	390	1300
Toluene	2.0	7.7	460	1800
Ethyl Benzene	2.0	8.8	27	120
Total Xylenes	2.0	8.8	86	380

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6112707**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2000**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	20	130	63000	410000
C2 - C4** Hydrocarbons	20	37	8900	16000

*TPH referenced to Jet Fuel (MW=156)
**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: MG-LRP Stack-1

ID#: 9511170-03A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112708**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.006	0.021	0.068
Toluene	0.002	0.008	0.12	0.46
Ethyl Benzene	0.002	0.009	0.011	0.048
Total Xylenes	0.002	0.009	0.053	0.23

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	**6112708**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.020	0.13	5.8	38
C2 - C4** Hydrocarbons	0.020	0.037	0.38	0.70

*TPH referenced to Jet Fuel (MW=156)

**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: MG-LRP Stack-2
ID#: 9511170-04A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112709**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.006	0.044	0.14
Toluene	0.002	0.008	0.17	0.65
Ethyl Benzene	0.002	0.009	0.017	0.075
Total Xylenes	0.002	0.009	0.056	0.25

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6112709**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.020	0.13	13	84
C2 - C4** Hydrocarbons	0.020	0.037	0.83	1.5

*TPH referenced to Jet Fuel (MW=156)
**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: MG-ICE Stack-1

ID#: 9511170-05A

EPA METHOD TO-3

(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112711**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**4.1**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.004	0.013	Not Detected	Not Detected
Toluene	0.004	0.016	Not Detected	Not Detected
Ethyl Benzene	0.004	0.018	Not Detected	Not Detected
Total Xylenes	0.004	0.018	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS

GC/FID

(Quantitated as Jet Fuel)

File Name:	**6112711**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**4.1**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.041	0.27	1.1	7.1
C2 - C4** Hydrocarbons	0.041	0.075	0.17	0.31

*TPH referenced to Jet Fuel (MW=156)

**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: MG-ICE Stack-2
ID#: 9511170-06A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112712**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.002	0.006	Not Detected	Not Detected
Toluene	0.002	0.008	Not Detected	Not Detected
Ethyl Benzene	0.002	0.009	Not Detected	Not Detected
Total Xylenes	0.002	0.009	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6112712**	**Date of Collection:**	**11/15/95**
Dil. Factor:	**2.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.020	0.13	1.4	9.1
C2 - C4** Hydrocarbons	0.020	0.037	0.23	0.42

*TPH referenced to Jet Fuel (MW=156)
**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: 1 Liter Summa Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9511170-07A

EPA METHOD TO-3
(Aromatic Volatile Organics in Air)

GC/PID

File Name:	**6112705**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
Benzene	0.001	0.003	Not Detected	Not Detected
Toluene	0.001	0.004	Not Detected	Not Detected
Ethyl Benzene	0.001	0.004	Not Detected	Not Detected
Total Xylenes	0.001	0.004	Not Detected	Not Detected

TOTAL PETROLEUM HYDROCARBONS
GC/FID
(Quantitated as Jet Fuel)

File Name:	**6112705**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Analysis:**	**11/27/95**

Compound	Det. Limit (ppmv)	Det. Limit (uG/L)	Amount (ppmv)	Amount (uG/L)
TPH* (C5+ Hydrocarbons)	0.010	0.065	Not Detected	Not Detected
C2 - C4** Hydrocarbons	0.010	0.018	Not Detected	Not Detected

*TPH referenced to Jet Fuel (MW=156)
**C2 - C4 Hydrocarbons referenced to Propane (MW=44)

Container Type: NA

AIR TOXICS LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

CHAIN-OF-CUSTODY RECORD

No. 006191

Page ___ of ___

Contact Person Stephen Rosinsky
Company Battelle
Address 505 King Ave City Columbus State OH Zip 43201
Phone 614-424-7289 FAX 614-424-3667
Collected By: Signature Stephen Rosinsky

Project info:
P.O. #
Project #6462201-30A0401
Project Name Biodripper

Turn Around Time:
☒ Normal
☐ Rush ___ Specify

Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum Initial	Final	Receipt
01A	MG-LRPReservoir-1	11/15/95 10:00	BTEX TPH	27	0	0.2psi
02A	MG-LRPReservoir-2	11/15/95 10:00	BTEX TPH	27	0	0.2psi
03A	MG-LRPstack-1	" " " "	BTEX TPH	27	0	0"Hg
04A	MG-LRPstack-2	" " " "	BTEX TPH	27	0	0.2psi
05A/B	MG-~~LRP~~ ICEstack-1	" " " "	BTEX TPH	27	0	0.5"Hg
06A	MG-ICEstack-2	" " " "	BTEX TPH	27	0	0.5"Hg
						11-17-95

Relinquished By: (Signature) Date/Time
Stephen Rosinsky
Print Name
STEPHEN ROSINSKY
Relinquished By: (Signature) Date/Time
Received By: (Signature) Date/Time
Relinquished By: (Signature) Date/Time
Received By: (Signature) Date/Time
Thomas Schuft AIR 11/17/95 930

Notes:

Lab Use Only	Shipper Name	Air Bill #	Opened By	Date/Time	Temp. (°C)	Condition	Custody Seals Intact?	Work Order #
	fed-x	5838982774 TS		11/17/95 930	Ambient	Good	Yes No (None) N/A	9511170

Form 1293 rev. 06

APPENDIX C

OPERATIONAL DATA FOR THE ICE

V.R.SYSTEMS INC.

MODEL V3 S/N 18[illegible]
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT	OIL	EXHAUST	OIL PSI	POSITIONS CARB.	BYPASS	WELL FLOW CFM-VAC.	H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM	THOUSANDS-UNITS	ENGINE HOURS
11/12/95 12:32:03 UNIT 182														
100 2447.	162.F	163.F	916.F	47.	20.8	-0.6	38.	-3.	14.3	38.5	0.623	2.59	21	463	185.
11/12/95 12:33:11 UNIT 182														
100 2290.	162.F	163.F	928.F	47.	OVRNG	-0.7	53.	-3.	14.5	39.5	0.621	1.88	21	465	185.
11/12/95 12:54:11 UNIT 18[illegible]														
100 2263.	162.F	164.F	924.F	47.	-0.2	13.5	116.	-5.	14.5	40.2	0.620	2.08	21	510	186.
11/12/95 13:50:37 UNIT 18[illegible]														
100 2235.	163.F	167.F	924.F	47.	-0.2	13.5	116.	-4.	14.4	38.3	0.623	2.06	21	630	187.
11/12/95 20:03:33 UNIT 18[illegible]														
100 2254.	164.F	167.F	921.F	47.	-0.4	13.5	116.	-1.	14.1	40.7	0.619	2.09	22	415	193.
11/13/95 09:24:48 UNIT 18[illegible]														
100 2223.	163.F	168.F	930.F	47.	-0.5	13.8	117.	0.	14.2	39.3	0.621	2.06	24	103	206.

Vacuum Enhanced Test

11/12/95 11:16

TO

11/16/95 13:15

ICE Results

(VR Times ~~are~~ amend by 1 hour)

Vacuum Enhanced Test

Unleaded

11/13/95 11:37:38 UNIT 182
100 2250. 162.F 170.F 932.F 47. -0.7 13.9 117. 0. 14.2 40.5 0.619 2.06 24 386 208.
11/13/95 11:43:41 UNIT 182
100 2239. 163.F 170.F 934.F 47. -0.7 13.9 117. 0. 14.1 42.1 0.616 2.06 24 399 208.
11/13/95 12:00:00 UNIT 182
100 2220. 163.F 171.F 933.F 47. -0.7 13.9 118. 0. 13.9 41.6 0.617 2.07 24 433 209.
11/13/95 12:58:11 UNIT 182
100 2243. 163.F 172.F 937.F 47. -0.8 14.0 118. 0. 13.9 42.9 0.614 2.09 24 556 210.
11/13/95 13:00:00 UNIT 182
100 2261. 163.F 173.F 938.F 47. -0.8 14.0 118. 1. 13.8 43.3 0.613 2.08 24 560 210.
11/13/95 14:00:00 UNIT 182
100 2240. 164.F 173.F 938.F 47. -0.8 14.0 118. 0. 13.8 42.3 0.615 2.08 24 688 211.
11/13/95 14:02:44 UNIT 182
100 1766. 162.F 171.F 924.F 47. OVRNG 3.6 73. 2. 13.9 42.3 0.615 1.80 24 693 211.
11/13/95 14:03:33 UNIT 182
100 1770. 161.F 169.F 901.F 47. OVRNG 3.6 72. 2. 13.9 45.5 0.609 1.46 24 695 211.
11/13/95 14:04:39 UNIT 182
100 1765. 161.F 168.F 887.F 47. OVRNG 2.2 68. 2. 13.7 45.3 0.609 1.39 24 696 211.
11/13/95 14:05:45 UNIT 182
100 1582. 161.F 166.F 873.F 47. OVRNG 0.8 64. 2. 13.8 43.5 0.613 1.26 24 698 211.
11/13/95 14:07:24 UNIT 182
100 1589. 160.F 163.F 853.F 47. OVRNG 0.8 63. 2. 13.8 45.3 0.609 1.19 24 700 211.
11/13/95 14:09:09 UNIT 182
100 1604. 160.F 162.F 841.F 47. OVRNG 0.8 64. 2. 13.8 45.2 0.610 1.20 24 702 211.
11/13/95 14:11:51 UNIT 182
100 1606. 160.F 159.F 840.F 47. OVRNG 0.8 64. 2. 13.8 46.9 0.606 1.22 24 705 211.
11/13/95 14:12:18 LIMIT 302 OIL PSI 28. LOW OIL PSI SD UNIT 182
11/13/95 14:12:20 LIMIT 414 ENG TMR OVRNG ENGINE FAILED ALARM UNIT 182
&ESTART AT: 11/13/95 14:15:40 (11/13/95 14:14:20) S5245 V2.23 .
11/13/95 14:15:43 UNIT 182
100 0. 179.F 138.F 535.F 0. -2.2 -25.0 0. -394. 0.0 0.1 0.700 0.00 24 706 211.
&ESTART AT: 11/13/95 14:16:35 (11/13/95 14:16:12) S5245 V2.23 .
11/13/95 14:16:38 UNIT 182

¿ESTART AT: 11/13/95 14:17:22 (11/13/95 14:16:55) S5245 V2.23 .
11/13/95 14:17:25 UNIT 182
100 . 0. 175.F 145.F 508.F 8. -2.1 -25.0 0. -393. 0.0 0.1 0.700 0.00 24 706 211.
¿ESTART AT: 11/13/95 14:17:53 (11/13/95 14:17:31) S5245 V2.23 .
11/13/95 14:17:56 UNIT 182
100 0. 173.F 141.F 481.F 100. -2.0 -25.0 0. -393. 0.0 0.1 0.700 0.00 24 706 211.
¿ESTART AT: 11/13/95 14:18:48 (11/13/95 14:18:13) S5245 V2.23 .
11/13/95 14:18:51 UNIT 182
100 0. 170.F 144.F 485.F 8. -2.0 -25.0 0. -393. 0.0 0.1 0.700 0.00 24 706 211.
¿ESTART AT: 11/13/95 14:20:05 (11/13/95 14:19:11) S5245 V2.23 .

V.R.SYSTEMS INC. MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT	OIL	EXHAUST	OIL PSI	POSITIONS CARB.	BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS		ENGINE HOURS
11/13/95 14:20:08 UNIT 182													
100 0.	166.F	138.F	467.F	23.	-2.1	-25.0	0. -393.	0.0	0.1	0.700	0.00	24	706 211.
¿ESTART AT: 11/13/95 14:20:44 (11/13/95 14:20:20) S5245 V2.23 .													
11/13/95 14:20:47 UNIT 182													
100 0.	166.F	133.F	437.F	100.	-1.9	-25.0	0. -392.	0.0	0.1	0.700	0.00	24	706 211.
¿ESTART AT: 11/13/95 14:22:00 (11/13/95 14:21:07) S5245 V2.23 .													
11/13/95 14:22:03 UNIT 182													
100 0.	164.F	135.F	450.F	9.	-2.0	-25.0	0. -392.	0.0	0.1	0.700	0.00	24	706 211.
¿ESTART AT: 11/13/95 14:22:53 (11/13/95 14:22:19) S5245 V2.23 .													
11/13/95 14:22:56 UNIT 182													
100 0.	165.F	139.F	449.F	13.	-2.0	-25.0	0. -392.	0.0	0.1	0.700	0.00	24	706 211.
¿ESTART AT: 11/13/95 14:26:42 (11/13/95 14:23:16) S5245 V2.23 .													
11/13/95 14:26:45 UNIT 182													
100 0.	159.F	117.F	349.F	22.	-2.0	-25.0	0. -391.	0.0	0.1	0.700	0.00	24	706 211.
¿ESTART AT: 11/13/95 14:29:44 (11/13/95 14:27:04) S5245 V2.23 .													
11/13/95 14:29:47 UNIT 182													
100 0.	156.F	112.F	319.F	7.	-2.0	-25.0	0. -391.	0.0	0.1	0.700	0.00	24	706 211.
¿ESTART AT: 11/13/95 14:31:37 (11/13/95 14:30:14) S5245 V2.23 .													
11/13/95 14:31:40 UNIT 182													
100 0.	155.F	116.F	315.F	8.	-2.0	-25.0	0. -391.	0.0	0.1	0.700	0.00	24	707 211.
¿ESTART AT: 11/13/95 14:35:56 (11/13/95 14:32:40) S5245 V2.23 .													
11/13/95 14:35:59 UNIT 182													
100 0.	150.F	97.F	273.F	0.	-1.9	-25.0	0. -391.	0.0	0.1	0.700	0.00	24	707 211.
¿ESTART AT: 11/13/95 15:10:56 (11/13/95 14:36:31) S5245 V2.23 .													
11/13/95 15:10:59 UNIT 182													
100 0.	116.F	63.F	136.F	29.	-25.0	-25.0	0. -388.	0.0	0.1	0.700	0.00	24	707 211.
11/13/95 15:12:30 UNIT 182													
100 692.	114.F	109.F	247.F	41.	7.4	-0.7	0. -1.	12.7	99.9	0.500	0.00	24	707 211.
11/13/95 15:15:02 UNIT 182													
100 1838.	130.F	120.F	552.F	47.	23.3	-0.6	0. -0.	14.4	10.8	0.678	0.00	24	707 211.
¿ESTART AT: 11/13/95 18:36:01 (11/13/95 16:26:04) S5245 V2.23 .													
11/13/95 18:36:04 LIMIT 110 BATTERY 0. @:0 14.1 LOW BAT'. VOLT ALARM 707 UNIT 182													
11/13/95 18:36:04 LIMIT 414 ENG TMR 4451. ENGINE FAILED ALARM UNIT 182													
11/13/95 18:36:04 UNIT 182													
100 0.	99.F	73.F	62.F	61.	-25.0	-25.0	0. -387.	0.0	0.1	0.700	0.00	24	707 212.
11/13/95 18:38:55 UNIT 182													
100 1813.	125.F	95.F	605.F	47.	23.6	-0.5	0. -1.	14.4	10.9	0.678	0.00	24	707 212.
11/13/95 19:01:14 UNIT 182													
100 1861.	156.F	158.F	834.F	53.	18.9	-0.5	0. 1.	14.1	50.2	0.600	0.00	24	708 213.
11/13/95 19:02:32 UNIT 182													
100 2087.	158.F	158.F	854.F	53.	20.6	-0.5	0. 1.	14.1	39.7	0.621	1.07	24	710 213.
11/13/95 19:03:07 UNIT 182													
100 2249.	160.F	159.F	883.F	53.	21.8	-0.5	0. 1.	14.1	42.9	0.614	2.35	24	712 213.
11/13/95 19:08:21 UNIT 182													
100 2438.	161.F	164.F	947.F	53.	22.1	-0.6	42. 1.	14.1	38.5	0.623	2.07	24	724 213.
11/13/95 19:10:38 UNIT 182													
100 2288.	161.F	166.F	947.F	53.	13.7	2.9	65. 0.	14.2	41.0	0.618	2.37	24	730 213.
11/13/95 20:00:00 UNIT 182													
100 2244.	162.F	171.F	931.F	52.	-0.2	13.3	115. 0.	14.1	41.9	0.616	2.24	24	845 214.
11/13/95 21:00:00 UNIT 182													

11/13/95 22:00:00 UNIT 182																
100	2251.	163.F	171.F	928.F	52.	-0.2	13.3	115.	-0.	14.1	39.9	0.620	2.24	25	120	216.

V.R.SYSTEMS INC. MODEL V3 S/N 182
PERMIT NO.

	ENGINE	TEMPERATURE			OIL	POSITIONS		WELL FLOW		BATTERY	DUTY	PERCENT	AUXILIARY FUEL			ENGINE
	RPM	COOLANT	OIL	EXHAUST	PSI	CARB.	BYPASS	CFM-VAC.H2O		VOLTS	CYCLE	OXYGEN	CFM THOUSANDS-UNITS			HOURS
11/13/95 23:00:00 UNIT 182																
100	2239.	163.F	172.F	928.F	52.	-0.2	13.3	115.	-0.	14.1	40.5	0.619	2.26	25	257	217.
11/14/95 00:00:00 UNIT 182																
100	2238.	163.F	171.F	929.F	52.	-0.2	13.3	115.	-1.	14.1	39.5	0.621	2.24	25	395	218.
11/14/95 01:00:00 UNIT 182																
100	2241.	163.F	172.F	928.F	52.	-0.2	13.3	115.	-1.	14.1	41.1	0.618	2.25	25	533	219.
11/14/95 02:00:00 UNIT 182																
100	2240.	163.F	171.F	928.F	52.	-0.2	13.3	115.	-1.	14.1	41.1	0.618	2.25	25	671	220.
11/14/95 03:00:00 UNIT 182																
100	2236.	163.F	172.F	928.F	52.	-0.2	13.3	115.	-1.	14.1	40.3	0.619	2.25	25	810	221.
11/14/95 04:00:00 UNIT 182																
100	2232.	164.F	172.F	926.F	52.	-0.3	13.3	115.	-2.	14.1	41.6	0.617	2.25	25	948	222.
11/14/95 05:00:00 UNIT 182																
100	2231.	163.F	172.F	927.F	52.	-0.2	13.3	115.	-2.	14.1	40.6	0.619	2.25	26	86	223.

100	2241.	163.F	175.F	927.F	52.	-0.3	13.3	115.	-2.	14.1	41.7	0.617	2.24	26	224	224.
11/14/95 07:00:00 UNIT 182																
100	2228.	163.F	172.F	927.F	52.	-0.3	13.3	115.	-2.	14.1	41.9	0.616	2.29	26	364	225.
11/14/95 08:00:00 UNIT 182																
100	2232.	163.F	172.F	929.F	52.	-0.3	13.3	115.	-3.	14.1	40.3	0.619	2.27	26	503	226.
11/14/95 09:00:00 UNIT 182																
100	2262.	164.F	174.F	927.F	52.	-0.3	13.1	114.	-3.	14.0	40.1	0.620	2.62	26	644	227.
11/14/95 10:00:00 UNIT 182																
100	2261.	163.F	174.F	921.F	52.	-0.3	12.9	114.	-4.	14.0	43.8	0.612	2.59	26	803	228.
11/14/95 11:00:00 UNIT 182																
100	2214.	163.F	174.F	924.F	52.	-0.3	12.9	114.	-4.	14.0	43.4	0.613	2.44	26	962	229.
11/14/95 12:00:00 UNIT 182																
100	2251.	163.F	175.F	946.F	52.	-0.3	14.2	118.	-5.	14.0	43.9	0.612	2.23	27	103	230.
11/14/95 13:00:00 UNIT 182																
100	2261.	163.F	175.F	941.F	52.	-0.3	14.2	118.	-5.	14.1	41.7	0.617	2.36	27	245	231.
11/14/95 14:00:00 UNIT 182																
100	2262.	163.F	174.F	940.F	52.	-0.3	14.2	117.	-6.	14.1	41.4	0.617	2.37	27	390	232.
11/14/95 15:00:00 UNIT 182																
100	2253.	163.F	174.F	940.F	52.	-0.3	14.2	117.	-7.	14.1	44.2	0.612	2.39	27	537	233.
11/14/95 16:00:00 UNIT 182																
100	2270.	163.F	175.F	938.F	52.	-0.3	14.2	117.	-8.	14.1	43.4	0.613	2.45	27	683	234.
11/14/95 17:00:00 UNIT 182																
100	2262.	163.F	174.F	939.F	52.	-0.3	14.1	117.	-8.	14.0	44.0	0.612	2.37	27	829	235.
11/14/95 18:00:00 UNIT 182																
100	2257.	163.F	174.F	935.F	52.	-0.3	14.1	117.	-9.	14.1	42.9	0.614	2.42	27	976	236.
11/14/95 19:00:00 UNIT 182																
100	2251.	163.F	174.F	937.F	52.	-0.3	14.1	116.	-9.	14.1	43.3	0.613	2.38	28	122	237.
11/14/95 20:00:00 UNIT 182																
100	2249.	163.F	174.F	935.F	52.	-0.3	14.1	116.	-10.	14.1	41.6	0.617	2.38	28	268	238.
11/14/95 21:00:00 UNIT 182																
100	2247.	164.F	174.F	935.F	52.	-0.3	14.1	116.	-11.	14.0	43.5	0.613	2.39	28	415	239.
11/14/95 22:00:00 UNIT 182																
100	2235.	164.F	174.F	938.F	52.	-0.3	14.1	116.	-11.	14.0	43.9	0.612	2.37	28	561	240.
11/14/95 23:00:00 UNIT 182																
100	2242.	164.F	177.F	945.F	52.	-0.1	14.6	118.	-10.	13.8	43.8	0.612	2.41	28	707	241.
11/15/95 00:00:00 UNIT 182																
100	2233.	164.F	178.F	954.F	52.	-0.6	15.0	119.	-11.	13.7	47.9	0.604	2.45	28	858	242.
11/15/95 01:00:00 UNIT 182																
100	2253.	163.F	176.F	953.F	52.	-0.6	14.9	119.	-11.	13.8	46.2	0.608	2.41	29	7	243.
11/15/95 02:00:00 UNIT 182																
100	2268.	161.F	172.F	945.F	52.	-0.6	14.9	119.	-11.	14.1	42.1	0.616	2.38	29	154	244.

V.R.SYSTEMS INC. MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT	TEMPERATURE OIL	TEMPERATURE EXHAUST	OIL PSI	POSITIONS CARB.	POSITIONS BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS	
11/15/95 03:00:00 UNIT 182													
100	2247.	162.F	172.F	946.F	52.	-0.6	14.9	119.	-11.	14.0	43.4	0.613	2.39	29	300	245.
11/15/95 04:00:00 UNIT 182																
100	2248.	162.F	171.F	944.F	52.	-0.6	14.9	120.	-11.	14.1	41.5	0.617	2.36	29	446	246.
11/15/95 05:00:00 UNIT 182																
100	2264.	162.F	171.F	942.F	52.	-0.5	15.0	120.	-11.	14.1	42.9	0.614	2.36	29	592	247.
11/15/95 06:00:00 UNIT 182																
100	2270.	162.F	172.F	940.F	52.	-0.5	14.9	120.	-11.	14.1	40.3	0.619	2.38	29	737	248.
11/15/95 07:00:00 UNIT 182																
100	2252.	162.F	170.F	935.F	52.	-0.3	14.7	119.	-11.	14.2	41.2	0.618	2.35	29	882	249.
11/15/95 08:00:00 UNIT 182																
100	2257.	162.F	170.F	934.F	52.	-0.3	14.7	119.	-11.	14.3	41.5	0.617	2.33	30	26	250.
11/15/95 09:00:00 UNIT 182																
100	2266.	162.F	170.F	935.F	52.	-0.1	14.7	119.	-11.	14.2	40.7	0.618	2.35	30	170	251.

11/15/95 11:00:00 UNIT 18															
100	2260.	162.F	170.F	936.F	52.	-0.0	14.7	119.	-10.	14.3	41.7	0.617	2.35	30	457	253.
11/15/95 12:00:00 UNIT 18															
100	2267.	162.F	170.F	937.F	53.	-0.3	14.8	118.	-10.	14.3	42.0	0.616	2.35	30	603	254.
11/15/95 13:00:00 UNIT 18															
100	2278.	162.F	170.F	936.F	53.	-0.3	14.8	118.	-9.	14.3	40.7	0.619	2.36	30	746	255.
11/15/95 14:00:00 UNIT 18															
100	2273.	162.F	170.F	937.F	53.	-0.1	14.8	119.	-9.	14.3	41.4	0.617	2.35	30	890	256.
11/15/95 15:00:00 UNIT 18															
100	2329.	163.F	172.F	950.F	53.	OVRNG	16.0	124.	-8.	14.4	40.0	0.620	2.45	31	40	257.
11/15/95 16:00:00 UNIT 18															
100	2257.	162.F	171.F	933.F	53.	-0.5	14.5	119.	-7.	14.3	39.3	0.621	2.31	31	183	258.
11/15/95 17:00:00 UNIT 18															
100	2247.	163.F	171.F	933.F	53.	-0.5	14.5	119.	-6.	14.2	40.7	0.619	2.31	31	325	259.
11/15/95 18:00:00 UNIT 18															
100	2237.	163.F	171.F	935.F	53.	-0.5	14.5	118.	-6.	14.2	40.2	0.620	2.32	31	467	260.
11/15/95 19:00:00 UNIT 18															
100	2239.	163.F	171.F	934.F	53.	-0.5	14.5	119.	-5.	14.3	40.5	0.619	2.29	31	608	261.
11/15/95 20:00:00 UNIT 18															
100	2246.	162.F	170.F	934.F	53.	-0.5	14.5	119.	-5.	14.3	42.0	0.616	2.31	31	749	262.
11/15/95 21:00:00 UNIT 18															
100	2251.	163.F	170.F	938.F	53.	-0.5	14.5	119.	-4.	14.2	40.3	0.619	2.28	31	890	263.
11/15/95 22:00:00 UNIT 18															
100	2249.	162.F	170.F	934.F	53.	-0.4	14.5	119.	-4.	14.3	41.2	0.618	2.30	32	31	264.
11/15/95 23:00:00 UNIT 18															
100	2251.	162.F	170.F	936.F	53.	-0.1	14.5	118.	-3.	14.3	39.1	0.622	2.30	32	172	265.
11/16/95 00:00:00 UNIT 18															
100	2266.	163.F	170.F	938.F	53.	-0.4	14.5	119.	-3.	14.2	39.5	0.621	2.29	32	314	266.
11/16/95 01:00:00 UNIT 18															
100	2263.	162.F	170.F	938.F	53.	-0.4	14.5	119.	-3.	14.3	38.9	0.622	2.31	32	455	267.
11/16/95 02:00:00 UNIT 18															
100	2253.	163.F	170.F	940.F	53.	-0.3	14.5	119.	-3.	14.3	39.4	0.621	2.30	32	597	268.
11/16/95 03:00:00 UNIT 18															
100	2249.	163.F	170.F	939.F	53.	-0.2	14.5	119.	-2.	14.3	39.9	0.620	2.30	32	738	269.
11/16/95 04:00:00 UNIT 18															
100	2262.	163.F	170.F	940.F	53.	-0.4	14.5	119.	-2.	14.3	39.0	0.622	2.30	32	880	270.
11/16/95 05:00:00 UNIT 18															
100	2249.	162.F	171.F	939.F	53.	-0.1	14.4	119.	-2.	14.3	39.0	0.622	2.29	33	21	271.
11/16/95 06:00:00 UNIT 18															
100	2254.	163.F	171.F	942.F	53.	-0.7	14.6	120.	-2.	14.2	39.0	0.622	2.32	33	163	272.

V.R.SYSTEMS INC. MODEL V3 S/N 18
PERMIT NO.

ENGINE	TEMPERATURE			OIL	POSITIONS		WELL FLOW	BATTERY	DUTY	PERCENT	AUXILIARY FUEL		ENGINE
RPM	COOLANT	OIL	EXHAUST	PSI	CARB.	BYPASS	CFM-VAC.H2O	VOLTS	CYCLE	OXYGEN	CFM THOUSANDS-UNITS		HOURS
11/16/95 07:00:00 UNIT 182													
100 2246.	163.F	171.F	943.F	53.	-0.7	14.6	119.	-2.	14.3	39.0	0.622	2.30	33	305	273.
11/16/95 08:00:00 UNIT 18													
100 2265.	163.F	173.F	940.F	53.	-0.3	14.5	119.	-2.	14.3	40.0	0.620	2.31	33	447	274.
11/16/95 09:00:00 UNIT 18													
100 2249.	163.F	174.F	941.F	53.	-0.2	14.5	119.	-1.	14.3	39.9	0.620	2.29	33	588	275.
11/16/95 10:00:00 UNIT 18													
100 2245.	163.F	172.F	938.F	53.	-0.2	14.5	120.	-1.	14.2	39.5	0.621	2.28	33	728	276.
11/16/95 11:00:00 UNIT 18													
100 2214.	163.F	171.F	941.F	53.	-0.2	14.5	119.	-1.	14.2	39.4	0.621	2.27	33	867	277.
11/16/95 12:00:00 UNIT 18													
100 2227.	163.F	172.F	941.F	53.	-0.2	14.5	120.	-2.	14.2	40.2	0.620	2.28	34	7	278.
11/16/95 13:00:00 UNIT 18													
100 2226.	164.F	172.F	940.F	53.	-0.2	14.5	120.	-2.	14.3	40.2	0.620	2.29	34	146	279.

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100 2245.  163.F  171.F  937.F  53.  -0.1  14.5  119.  -2.  14.3  40.4  0.617  2.28  34  288  280.
11/16/95 14:00:52 UNIT 182
100 2230.  163.F  171.F  938.F  53.  -0.1  14.5  119.  -2.  14.4  39.2  0.622  2.27  34  288  280.
11/16/95 14:02:37 UNIT 182
100 2152.  163.F  171.F  928.F  53.  -0.1  13.0  115.  -2.  14.3  41.9  0.616  2.15  34  292  280.
11/16/95 14:03:31 UNIT 182
100 2182.  163.F  170.F  922.F  53.  3.7  10.3  102.  -1.  14.3  41.1  0.618  2.14  34  294  280.
11/16/95 14:04:16 UNIT 182
100 2199.  163.F  170.F  928.F  53.  8.4  7.4  87.  -0.  14.3  39.6  0.621  2.20  34  296  280.
11/16/95 14:05:04 UNIT 182
100 2203.  163.F  170.F  929.F  53.  12.8  3.0  66.  0.  14.3  39.4  0.621  2.21  34  298  280.
11/16/95 14:05:34 UNIT 182
100 2212.  162.F  171.F  928.F  53.  15.0  -0.3  54.  0.  14.3  40.6  0.619  2.22  34  299  280.
11/16/95 14:06:03 UNIT 182
100 2216.  163.F  170.F  929.F  53.  15.2  -0.4  54.  1.  14.3  40.0  0.620  2.23  34  300  280.
11/16/95 14:06:40 UNIT 182
100 2073.  163.F  170.F  929.F  53.  13.1  -0.4  56.  1.  14.3  42.1  0.616  2.22  34  301  280.
11/16/95 14:07:55 UNIT 182
100 1841.  161.F  168.F  884.F  53.  9.3  -0.4  58.  1.  14.4  41.6  0.617  1.72  34  303  280.
11/16/95 14:08:04 UNIT 182
100 1851.  161.F  168.F  880.F  53.  9.3  -0.4  58.  0.  14.4  41.1  0.618  1.70  34  304  280.
11/16/95 14:10:02 UNIT 182
100 1759.  161.F  164.F  828.F  53.  18.5  -0.4  0.  1.  14.4  49.1  0.602  0.00  34  306  280.
11/16/95 14:10:17 UNIT 182
100 1528.  161.F  164.F  821.F  53.  15.9  -0.5  0.  1.  14.4  47.8  0.604  0.00  34  306  280.
¿ESTART AT: 11/17/95 16:13:34 (11/16/95 14:21:13) S5245  V2.23 .
11/17/95 16:13:37 LIMIT  414 ENG TMR  OVRNG     ENGINE FAILED ALARM      UNIT 182
11/17/95 16:13:37 UNIT 182
100  2.  43.F  47.F  46.F  44.  10.9  -0.3  0.  -1.  12.6  99.9  0.500  0.00  34  306  280.
¿ESTART AT: 11/17/95 16:15:39 (11/17/95 16:13:50) S5245  V2.23 .
11/17/95 16:15:42 UNIT 182
100  1.  43.F  47.F  46.F  0.  10.9  -0.3  0.  -0.  12.6  99.9  0.500  0.00  34  306  280.
¿ESTART AT: 11/17/95 16:21:00 (11/17/95 16:16:00) S5245  V2.23 .
11/17/95 16:21:03 UNIT 182
100  2.  43.F  49.F  46.F  2.  11.4  -0.3  0.  -0.  12.7  99.9  0.500  0.00  34  306  280.
¿ESTART AT: 11/17/95 16:24:19 (11/17/95 16:21:37) S5245  V2.23 .
11/17/95 16:24:22 UNIT 182
100  2.  43.F  50.F  46.F  0.  13.5  -0.3  0.  0.  12.7  99.9  0.500  0.00  34  306  280.
RESTART AT: 11/17/95 16:26:57 (11/17/95 16:24:38) S5245  V2.23 .
11/17/95 16:27:00 UNIT 182
100  2.  44.F  51.F  46.F  18.  14.6  -0.3  0.  -0.  12.7  99.9  0.500  0.00  34  306  280.
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11/17/95 - 11/19/95

¿ESTART AT: 11/17/95 16:36:27 (11/17/95 16:27:19) S5245 V2.23 .
V.R.SYSTEMS INC. MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT	OIL	EXHAUST	OIL PSI	POSITIONS CARB.	BYPASS	WELL FLOW CFM-VAC.H2O		BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM	THOUSANDS-UNITS	ENGINE HOURS
11/17/95 16:36:30 UNIT 182														
100 2.	45.F	52.F	45.F	19.	15.8	-0.3	0.	0.	12.7	99.9	0.500	0.00	34	306	280.
11/17/95 16:43:43 UNIT 182														
100 1620.	142.F	103.F	641.F	47.	17.5	-0.3	0.	1.	14.5	10.7	0.679	0.00	34	307	280.
11/17/95 16:56:49 UNIT 182														
100 1641.	156.F	150.F	696.F	47.	17.5	-0.4	0.	2.	14.5	10.6	0.679	0.00	34	307	280.
11/17/95 17:29:31 UNIT 182														
100 1625.	158.F	152.F	699.F	47.	17.5	-0.4	0.	2.	14.5	10.4	0.679	0.00	34	308	281.
11/17/95 17:32:45 UNIT 182														
100 2282.	161.F	159.F	889.F	47.	15.0	0.7	58.	1.	14.5	40.6	0.619	2.53	34	314	281.
11/17/95 18:00:00 UNIT 182														
100 2233.	162.F	171.F	934.F	47.	-0.1	13.8	118.	-0.	14.2	41.5	0.617	2.55	34	385	281.
11/17/95 19:00:00 UNIT 182														
100 2223.	163.F	171.F	937.F	47.	-0.1	14.2	118.	-0.	14.2	39.4	0.621	2.56	34	540	282.
11/17/95 20:00:00 UNIT 182														
100 2222.	163.F	171.F	939.F	47.	-0.1	14.2	118.	-0.	14.2	41.2	0.618	2.57	34	697	283.
11/17/95 21:00:00 UNIT 182														
100 2244.	163.F	171.F	940.F	47.	-0.2	14.5	118.	-0.	14.2	39.0	0.622	2.58	34	854	284.
11/17/95 22:00:00 UNIT 182														
100 2256.	163.F	171.F	941.F	47.	3.1	14.5	118.	-0.	14.3	38.8	0.622	2.61	35	11	285.
11/17/95 23:00:00 UNIT 182														
100 2253.	163.F	171.F	941.F	47.	-0.2	14.5	119.	0.	14.3	37.8	0.624	2.61	35	168	286.
11/18/95 00:00:00 UNIT 182														
100 2250.	163.F	171.F	941.F	47.	-0.2	14.5	119.	0.	14.3	39.2	0.622	2.57	35	325	287.
11/18/95 01:00:00 UNIT 182														
100 2249.	163.F	173.F	936.F	47.	-0.2	14.3	118.	-0.	14.3	38.9	0.622	2.55	35	481	288.
11/18/95 02:00:00 UNIT 182														
100 2247.	163.F	171.F	940.F	47.	-0.2	14.5	118.	-0.	14.3	39.6	0.621	2.58	35	638	289.
11/18/95 03:00:00 UNIT 182														
100 2260.	163.F	171.F	940.F	47.	-0.3	14.5	118.	-0.	14.3	39.5	0.621	2.59	35	796	290.
11/18/95 04:00:00 UNIT 182														
100 2235.	163.F	173.F	941.F	47.	-0.3	14.4	118.	-0.	14.2	41.1	0.618	2.62	35	955	291.
11/18/95 05:00:00 UNIT 182														
100 2253.	163.F	173.F	941.F	47.	-0.3	14.5	119.	0.	14.2	41.3	0.617	2.62	36	113	292.
11/18/95 06:00:00 UNIT 182														

11/18/95 07:00:00 UNIT 182
100 2250. 163.F 173.F 943.F 47. -0.3 14.6 119. -0. 14.2 41.9 0.616 2.64 36 431 294.
11/18/95 08:00:00 UNIT 182
100 2255. 163.F 173.F 942.F 47. -0.3 14.7 119. -0. 14.2 40.7 0.619 2.61 36 591 295.
11/18/95 09:00:00 UNIT 182
100 2272. 163.F 172.F 934.F 47. -0.3 14.0 116. 0. 14.2 39.1 0.622 2.64 36 751 296.
11/18/95 09:16:05 UNIT 182
100 2219. 163.F 172.F 917.F 47. 14.2 -0.6 53. 3. 14.3 40.5 0.619 2.54 36 793 297.
11/18/95 09:16:54 UNIT 182
100 1941. 162.F 171.F 910.F 47. 9.4 -0.6 57. 3. 14.2 43.1 0.614 2.41 36 795 297.
11/18/95 09:17:06 UNIT 182
100 1879. 162.F 170.F 902.F 47. 8.4 -0.6 57. 3. 14.3 42.4 0.615 2.35 36 795 297.
11/18/95 09:18:00 LIMIT 414 ENG TMR 60077. ENGINE FAILED ALARM UNIT 182
11/18/95 09:18:00 LIMIT 302 OIL PSI 25. LOW OIL PSI SD UNIT 182
¿ESTART AT: 11/18/95 17:20:02 (11/18/95 09:18:09) S5245 V2.23 .
11/18/95 17:20:05 UNIT 182
100 2. 52.F 47.F 45.F 0. 9.9 -0.5 0. -2. 12.5 99.9 0.500 2.00 36 797 297.
¿ESTART AT: 11/18/95 17:23:11 (11/18/95 17:21:56) S5245 V2.23 .

ENGINE RPM	TEMPERATURE COOLANT	TEMPERATURE OIL	TEMPERATURE EXHAUST	OIL PSI	POSITIONS CARB.	POSITIONS BYPASS	WELL FLOW CFM-VAC.H2O	BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS	ENGINE HOURS
11/18/95 20:58:54 UNIT 182												
100 2.	48.F	44.F	43.F	0.	23.4	-0.6	0. -2.	12.6	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 20:59:52 (11/18/95 20:59:16) S5245 V2.23 .												
11/18/95 20:59:55 UNIT 182												
100 2.	48.F	45.F	43.F	6.	23.4	-0.6	0. -1.	12.5	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:02:55 (11/18/95 21:00:25) S5245 V2.23 .												
11/18/95 21:02:58 UNIT 182												
100 2.	48.F	45.F	43.F	11.	23.5	-0.6	0. -2.	12.6	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:04:14 (11/18/95 21:03:19) S5245 V2.23 .												
11/18/95 21:04:17 UNIT 182												
100 2.	48.F	45.F	44.F	27.	23.5	-0.6	0. -2.	12.6	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:04:58 (11/18/95 21:04:27) S5245 V2.23 .												
11/18/95 21:05:01 UNIT 182												
100 2.	48.F	45.F	44.F	2.	23.4	-0.6	0. -1.	12.5	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:07:31 (11/18/95 21:06:40) S5245 V2.23 .												
11/18/95 21:07:34 UNIT 182												
100 2.	48.F	45.F	44.F	20.	19.9	-0.6	0. -1.	12.5	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:09:53 (11/18/95 21:09:29) S5245 V2.23 .												
11/18/95 21:09:56 UNIT 182												
100 2.	48.F	45.F	44.F	0.	24.3	-0.6	0. -1.	12.5	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:10:56 (11/18/95 21:10:06) S5245 V2.23 .												
11/18/95 21:10:59 UNIT 182												
100 2.	48.F	45.F	44.F	11.	24.5	-0.6	0. -1.	12.5	99.9	0.500	0.00 36	797 297.
¿ESTART AT: 11/18/95 21:11:44 (11/18/95 21:11:23) S5245 V2.23 .												
11/18/95 21:11:47 UNIT 182												
100 0.	48.F	45.F	44.F	4.	-25.0	-25.0	0. -369.	0.0	0.1	0.700	0.00 36	797 297.
RESTART AT: 11/18/95 21:12:35 (11/18/95 21:12:02) S5245 V2.23 .												
11/18/95 21:12:38 UNIT 182												
100 2.	48.F	45.F	44.F	100.	24.5	-0.6	0. -1.	12.5	99.9	0.500	0.00 36	797 297.
11/18/95 21:16:48 UNIT 182												
100 1387.	121.F	70.F	815.F	43.	25.3	-0.9	25. -1.	13.8	10.8	0.678	0.00 36	797 297.
11/18/95 21:24:20 UNIT 182												
100 1621.	155.F	147.F	935.F	49.	26.8	-1.0	24. 0.	13.9	10.9	0.678	0.00 36	797 297.
11/18/95 22:00:00 UNIT 182												
100 2225.	161.F	171.F	934.F	47.	-2.4	14.3	118. -2.	14.0	42.2	0.616	2.62 36	873 297.
11/18/95 23:00:00 UNIT 182												
100 2204.	163.F	174.F	941.F	47.	-2.4	14.4	119. -3.	13.9	41.1	0.618	2.63 37	32 298.
11/19/95 00:00:00 UNIT 182												
100 2237.	164.F	176.F	942.F	47.	-2.4	14.7	120. -2.	14.0	41.5	0.617	2.66 37	193 299.
11/19/95 01:00:00 UNIT 182												
100 2236.	163.F	175.F	941.F	47.	-2.4	14.7	119. -2.	14.0	41.0	0.618	2.65 37	354 300.
11/19/95 02:00:00 UNIT 182												
100 2218.	163.F	174.F	940.F	47.	-2.4	14.7	119. -4.	14.0	40.8	0.618	2.60 37	515 301.
11/19/95 03:00:00 UNIT 182												
100 2224.	163.F	173.F	942.F	47.	-2.4	15.0	120. -3.	14.0	41.8	0.616	2.65 37	675 302.
11/19/95 04:00:00 UNIT 182												
100 2231.	163.F	174.F	941.F	47.	-2.4	15.0	120. -4.	14.0	42.0	0.616	2.66 37	836 303.
11/19/95 05:00:00 UNIT 182												
100 2259.	164.F	175.F	945.F	47.	-2.4	15.2	121. -4.	14.0	41.7	0.617	2.68 37	997 304.
11/19/95 06:00:00 UNIT 182												
100 2231.	163.F	173.F	943.F	47.	-2.4	15.2	121. -3.	14.1	42.1	0.616	2.65 38	159 305.
11/19/95 07:00:00 UNIT 182												
100 2250.	162.F	173.F	944.F	47.	-2.4	15.2	121. -3.	14.1	40.9	0.618	2.67 38	321 306.
11/19/95 08:00:00 UNIT 182												
100 2234.	163.F	172.F	941.F	47.	-2.4	15.2	121. -3.	14.1	38.3	0.623	2.65 38	482 307.

V.R.SYSTEMS INC. MODEL V3 S/N 182
PERMIT NO.

ENGINE RPM	TEMPERATURE COOLANT	OIL	EXHAUST	OIL PSI	POSITIONS CARB.	BYPASS	WELL FLOW CFM-VAC.H2O		BATTERY VOLTS	DUTY CYCLE	PERCENT OXYGEN	AUXILIARY FUEL CFM THOUSANDS-UNITS		ENGINE HOURS
11/19/95 09:00:00 UNIT 182														
100 2248.	163.F	173.F	943.F	47.	-2.4	15.2	120.	-3.	14.1	40.3	0.619	2.65	38 643	308.
11/19/95 10:00:00 UNIT 182														
100 2225.	163.F	173.F	943.F	47.	-2.4	15.2	121.	-3.	14.0	39.8	0.620	2.66	38 805	309.
11/19/95 11:00:00 UNIT 182														
100 2215.	164.F	175.F	946.F	47.	-2.4	15.2	121.	-2.	14.0	39.9	0.620	2.63	38 966	310.
11/19/95 11:08:05 UNIT 182														
100 2228.	164.F	174.F	946.F	47.	-2.4	15.2	122.	-2.	14.0	41.9	0.616	2.65	38 987	311.
11/19/95 12:00:13 UNIT 182														
100 2253.	163.F	175.F	945.F	47.	-2.4	15.6	123.	-2.	13.9	25.9	0.648	2.69	39 125	311.
11/19/95 12:07:41 UNIT 182														
100 2170.	163.F	174.F	928.F	47.	14.8	-0.4	53.	1.	14.0	43.4	0.613	2.60	39 145	312.
11/19/95 12:07:55 UNIT 182														
100 2027.	162.F	174.F	927.F	47.	12.3	-0.4	55.	1.	13.8	45.1	0.610	2.55	39 146	312.
11/19/95 12:08:18 UNIT 182														
100 1853.	161.F	173.F	914.F	47.	9.4	-0.4	56.	1.	14.0	42.0	0.616	2.38	39 147	312.
11/19/95 12:39:46 LIMIT 414 ENG TMR 55624. ENGINE FAILED ALARM UNIT 182														

APPENDIX D

SYSTEM CHECKLIST

Checklist for System Shakedown

Site: Mcguire AFB

Date: _____ Operator's Initials: _____

Equipment	Check if Okay	Comments
Liquid Ring Pump	✓	
Aqueous Effluent Transfer Pump	✓	
Oil/Water Separator	✓	
Vapor Flowmeter	✓	magnehelic gauges stuck. Replaced with new.
Fuel Flowmeter	✓	
Water Flowmeter	✓	Replaced battery
Emergency Shut off Float Switch		
Effluent Transfer Tank	✓	
Analytical Field Instrumentation		
GasTector™ O_2/CO_2 Analyzer	✓	
TraceTector™ Hydrocarbon Analyzer	✓	
Oil/Water Interface Probe	✓	
Magnehelic Boards	✓	
Thermocouple Thermometer	✓	

APPENDIX E

DATA SHEETS FROM THE SHORT-TERM PILOT TEST

ATMOSPHERIC OBSERVATIONS

Site: McGuire AFB Operators: _____

Date/Time	Ambient Temperature	Relative Humidity	Barometric Pressure
11/12/95 1415	41 °F	53 %	29.62 " Hg
11/13/95 0806	39.9 °F	44 %	28.9 " Hg
11/13/95 2045 11/14/95 0715	43.2 °F 32.2 °F	88 %	29.45 " Hg
11/14/95 1600	46 °F		
11/15/95 0730	42 °F	78 %	28.9 " Hg
11/15/95 2000	40 °F	82 %	
11/16/95 0800	35 °F		29.7 " Hg
11/17/95 1700	40 °F		29.75
11/18/95	34		29.85
11/19/95	38	80 %	29.60

Baildown Test Record Sheet

Site: McGuire AFB

Well Identification: 08MW19

Well Diameter (OD/ID): 4"

Date at Start of Test: 11/9/95

Sampler's Initials: ____

Time at Start of Test: 2:18 (1418)

Initial Readings

Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Total Volume Bailed (L
12.89	16.80	3.91	

Test Data

Sample Collection Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
1418	14.70	14.76	0.06
1419	14.42	14.57	0.15
1422	14.25	14.42	0.17
1431	13.94	14.25	0.31
1443	13.80	14.22	0.42
1451	13.75	14.25	0.50
1520	13.68	14.38	0.70
1608	13.62	14.52	0.90
1716	13.56	14.72	1.16
~~1942~~ 0744	13.47	15.0	1.53
0744	13.29	15.59	2.30

Baildown Test Record Sheet

Site: mcguire AFB

Well Identification: 08 mw12

Well Diameter (OD/ID): 4"

Date at Start of Test: 11/9/95 Sampler's Initials: ____

Time at Start of Test: 1445

Initial Readings

Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Total Volume Bailed (L
13.15	16.11	2.96	

Test Data

Sample Collection Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
0 1445	15.13	15.33	0.20
1447	14.91	15.26	0.35
1450	14.75	15.16	0.41
1455	14.42	14.97	0.55
1516	13.90	14.57	0.67
1610	13.70	14.43	0.73
1717	13.67	14.47	0.80
1944	13.65	14.56	0.91
0745	13.60	14.65	1.05

Baildown Test Record Sheet

Site: McGuire AFB

Well Identification: 08MW51

Well Diameter (OD/ID): 4"

Date at Start of Test: 11/9/95 Sampler's Initials: ____

Time at Start of Test: 1538

Initial Readings

Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Total Volume Bailed (L
13.39	17.32	3.93	

Test Data

Sample Collection Time	Depth to Groundwater (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)
1538	16.37	16.45	0.08
1540	16.0	16.08	0.08
1549	15.22	15.33	0.11
1611	14.45	14.68	0.23
1720	14.27	14.52	0.25
1945	14.24	14.61	0.37
~~1947~~			
0747	14.18	14.78	0.60

Bioslurping Pilot Test
(Data Sheet 1)
Well Characteristics

Page ___ of ___

Site: mcguire AFB

Test Type (skimmer, bioslurper vacuum extraction, drawdown): skimmer (48 hour)

Depth to Groundwater: 15.59 Depth to Fuel: 13.29 Depth of Slurper Tube: 14.75' (initial) 13.97 (final)

Date at Start of Test: 11/10/95

Time at Start of Test: 0900 Operator's Initials: _____

Date/Time	Well ID: 08mW19 LNAPL Level	Water Level	Pressure (in H_2O)	Well ID: LNAPL Level	Water Level	Pressure (in H^2O)	Well ID: LNAPL Level	Water Level	Pressure (in H_2O)
11/10/95 0900	13.29	15.59							
0945	13.97	13.98							
1343	13.97	13.975							
11/11/95 0745	13.59	14.2							
11/12/95 0800	13.64	13.86							

Bioslurping Pilot Test
(Data Sheet 1)
Well Characteristics

Page ___ of ___

Site: McGuire AFB

Test Type (skimmer, bioslurper vacuum extraction, drawdown): Vacuum Enhanced

Depth to Groundwater: 13.64' Depth to Fuel: 13.86' Depth of Slurper Tube: 13' 11"

Date at Start of Test: 11/12/95

Time at Start of Test: 1115 Operator's Initials: SR JG

Date/Time	Well ID: LNAPL Level	Water Level	Pressure (in H_2O)	Well ID: LNAPL Level	Water Level	Pressure (in H^2O)	Well ID: LNAPL Level	Water Level	Pressure (in H_2O)
1025 11/12/95	10.31	NA	NA						
1315 11/12/95	10.39	NA	NA						
0806 11/13/95	11.18	15.05	NA						
0715 11/14/95	10.2	14.37	NA						
2000 11/15/95	9.76	13.81	0.075						
0800 11/16/95	9.68	13.30	0						
1300 11/16/95	9.65	13.15	0.015						

Distance from well 08MW19 = 55'

Bioslurping Pilot Test
(Data Sheet 1)
Well Characteristics

Page ___ of ___

Site: mcguire AFB

Test Type (skimmer, bioslurper vacuum extraction, drawdown): skimmer (24 hour)

Depth to Groundwater: ~~N/A~~ 15.58 Depth to Fuel: — Depth of Slurper Tube: 15.5' (initial) 13.2' (final)

Date at Start of Test: 11/16/95

Time at Start of Test: 1400 Operator's Initials: ___

Date/Time	Well ID:			Well ID:			Well ID:		
	LNAPL Level	Water Level	Pressure (in H_2O)	LNAPL Level	Water Level	Pressure (in H^2O)	LNAPL Level	Water Level	Pressure (in H_2O)
1350 11/16/95	—	15.58							
2140 11/16/95	13.22	13.23							
0730 11/17/95	12.95	13.35							
1400 11/17/95	13.23	13.24							

Bioslurping Pilot Test
(Data Sheet 3)
Fuel and Water Recovery Data

Page ___ of ___

Site: McGuire AFB

Start Date: 11/10/95

Test Type: Skimmer (2 day)

Operators: _____

Date/Time	Run Time	LNAPL Recovery (L) (volume collected in time period)	Groundwater Recovery (L) (volume collected in time period)
11/10/95 9:00	0		
0930	30	18.5	4.5 L
1000	60	1.2	0.8 L
1015	75	0.4	1.8 L
1030	90	0.25	2.2 L
1120	140	1.25	6.9 L
1204	184	0.55	10.0 L
1245	225	0.50	7.5 L
1336	276	0.70	9.0 L
1422	322	0.40	7.5 L
1510	370	0.25	9.0 L
1630	450	0.90	14.0 L
2100	720	0.40 gal	5.7 gal
11/11/95			
0745		2 gal	25 gal
1630		1 gal	40 gal
11/12/95			
0645		1.2 gal	85 gal
TOTALS:		11.2 gal	175 gal

Bioslurping Pilot Test
(Data Sheet 3)
Fuel and Water Recovery Data

Page ___ of ___

Site: mcguire AFB

Start Date: 11/12/95

Test Type: Vacuum Enhanced

Operators: _____

Date/Time	Run Time	LNAPL Recovery (L) (volume collected in time period)	Groundwater Recovery (gal) (volume collected in time period)
11/12/95 1115	0		
1145	0.5	0.4	103
1215	1	0	67
1245	1.5	0	94
1315	2	0	92
1415	3	0	136
1815	7	0	824
2215	11	0	623
11/13/95 0806	20.9	5	2316
1330	26.2	38.4 (From filter box and left side of separator. Accumulated during first 26 hours of test)	911
2045	29	4	NA
11/14/95 0715	39.5	28	1922
1020	42.6	89 (From filter tank)	NA
1600	48.2	10 (From left side of separator)	1229
2130	53.7	4	1251
11/15/95 0730	63.7	35	2817
1000	66.2	40 (From filter box)	NA
2000	76.2	87 (75 L from filter box 10 L from left side of separator)	2101
11/16/95 0800	84.2	10	2034
1300	89.2	65 (10 from left side of sep 45 from filter box)	713

unless noted, product was recovered from product storage compartment (right side of seperator)

SLURPPT.DS3 (G462201-1001 DISK)

Bioslurping Pilot Test
(Data Sheet 3)
Fuel and Water Recovery Data

Page ___ of ___

Site: mcguire AFB

Start Date: 11/16/95

Test Type: skimmer (24 hour)

Operators: _____

Date/Time	Run Time	LNAPL Recovery (L) (volume collected in time period)	Groundwater Recovery (gal) (volume collected in time period)
11/16/95 1400	0		
1430	(0.5) 30mn	0.05	2.64
1500	(1) 60mn	0.03	3.70
1530	1.5	0.03	2.64
1600	2	0.05	3.17
1700	3	0.15	10
1800	4	0.30	13
2140	7.67	2.8	33
11/17/95 0730	17.5	10.5	27
1400	24	11	13

Bioslurping Pilot Test
(Data Sheet 3)
Fuel and Water Recovery Data

Page ___ of ___

Site: McGuire AFB

Start Date: 11/17/95

Test Type: Drawdown

Operators: SR

Date/Time	Run Time	LNAPL Recovery (volume collected in time period)	Groundwater Recovery (gal) (volume collected in time period)
11/17/95 1530	0		
1630	1	0.15	49.8
1700	1.5	0	28
1730	2	0	20
1800	2.5	0.10	29
2000	4.5	0.80	49
11/18/95 0731	16	2 (emulsion) from leftside of sep	NA
0800	16.5		
1630	16.5		
1800	18	0	87
2015	20.2	0.150	124
2130	21.5	0	53
11/19/95 0715	32.25	2.5 L (emulsion from separator)	(leftside) 460
1130	36.5	0.150 + 1L emulsion	206

Bioslurping Pilot Test
(Data Sheet 2)
Pilot Test Pumping Data

Page ___ of ___

Site: McGuire AFB

Start Date: 11/12/95

Operators: S.R J.E

Start Time: 1115

Test Type: Vacuum Enhanced

Well ID: 03MW19

Depth to Groundwater: 13.64' Depth to Fuel: 13.86' Depth of Tube: 13' 11"

Date/Time	Run Time	Vapor Extraction			Pump Stack Temp (°C)	Pump Head Vacuum (in. Hg)	Extraction Well Vacuum (in. ~~H_2O~~ Hg)
		Stack Pressure (in. H_2O)	Carbon Drums (in. H_2O)	Flowrate (scfm)			
1115 11/12/95	0						
1215	1	0.30			20.3	22	>60" H_2O
1245	1.5	0.35			21.0	24	12" Hg
1315	2	0.35			21.0	24	12"
1415	3	0.35			21.1	24	12
1815	7	0.35			20.0	25	12
2215	11	0.35			20.2	25	12.5
0806 11/13/95	20.9	0.35				24	13
2045	29	0.40			22.0	26.5	13
0715 11/14/95	39.5	0.40			16.4	26.5	13
1600	48.2	0.40				26	13
0730 11/15/95	63.7	0.25			25.3	26	12
2000	76.2	0.20			28.3	26	12
0800 11/16/95	84.2	0.20			28.2	26	12
1300	89.2	0.35			28.6	26	12

Bioslurping Pilot Test
(Data Sheet 2)
Pilot Test Pumping Data

Page ___ of ___

Site: McGuire AFB

Start Date: 11/17/95

Operators: SR

Start Time: 1530

Test Type: Drawdown

Well ID: 08MW19

Depth to Groundwater: 13.24 Depth to Fuel: 13.23 Depth of Tube: 18.55' *

Date/Time	Run Time	Vapor Extraction			Pump Stack Temp (°C)	Pump Head Vacuum (in. Hg)	Extraction Well Vacuum (in. H_2O)
		Stack Pressure (in. H_2O)	Carbon Drums (in. H_2O)	Flowrate (scfm)			
1530 11/17/95	0	~~0.09~~			~~31.9~~	~~20~~	Ambient
1630	1	0.09			31.9	20	Ambient
1700	1.5	0.05			33.0	20	Ambient
1730	2	0.04			33.8	20	Ambient
1800	2.5	0.05			34.2	20	Ambient
2000	4.5	0.05			33.8	20	Ambient
2300	7.5	0.05			33.2	20	Ambient
0731 11/18/95	16	0.055			33.7	20	Ambient
1800	18						
2015	20.25	0.06			33.8	20	Ambient
2130	21.5	0.06			34.0	20	Ambient
0715 11/19/95	32.25	0.065			34.0	20	Ambient
1130	36.5	0.07			34.3	19	Ambient

* Includes 2.31' extension on casing to accomodate tee.

APPENDIX F

SOIL GAS PERMEABILITY TEST RESULTS

Record Sheet for Air Permeability Test

Site mcguire AFB	Monitoring Point mpA and mpB
Blower Type 7.5 HP Liquid Ring Pump	Distance from Vent Well mpA = 10' mpB = 20'
Depth of Point	Recorded by 11/12/95 11:15

Time	~~MP1~~ mpA-3	~~MP2~~ mpA-6	MP3
0	>0	>0	
2	>0	>0	
5	>0	-0.20	
11	>0	0	
13	>0	0	
16	0	0	
28	0	0	
40	0	0	
60	0	0	
90	>0	>0	
120	0	0	
3 hrs	0	0	
7 hrs	-0.005	-0.04	
21 hrs	0	-0.02	
47 hrs	>0	>0	
68.25	0	-0.03	
~~47.25~~			

Time	~~MP1~~ mpB-3	~~MP2~~ mpB-6	~~MP3~~ mpB-9
2	>0	>0	-0.5
5	>0	>0	-0.25
7	>0	>0	-0.05
10	>0	>0	-0.07
12	>0	>0	-0.10
15	>0	>0	-0.09
20	0	0	-0.15
30	-0.02	-0.04	-0.45
40	-0.01	-0.03	-0.40
60	>0	>0	-0.60
90	>0	>0	-0.40
120	>0	>0	-1.05
3 hrs	0	0	-2.6
7 hrs	0	-0.07	-6.5
21 hrs	-0.03	-0.065	-14
47 hrs	~~18~~ >0	~~-20~~ >0	~~-18~~ -12
68.25	-0.01	-0.02	-20

Record Sheet for Air Permeability Test							
Site mcguire AFB				Monitoring Point mpc			
Blower Type 7.5 HP Liquid Ring pump				Distance from Vent Well mpc = 30'			
Depth of Point				Recorded by			
Time	~~MP1~~ mpc-2.5	~~MP2~~ mpc-6	~~MP3~~ mpc-9	Time	MP1	MP2	MP3
0	>0	>0	0				
2	>0	'12	<-20				
5	>0	-4	-24				
7	-0.03	-0.9	-24				
10	0	-0.25	-18				
12	-0.04	-1.05	-20				
15	0	-0.08	-10				
20	0	-0.09	-6.5				
30	-0.02	-0.25	-5.5				
40	>0	-0.09	-7.0				
60	0	-0.06	-5.0				
90	0	-0.095	-5.0				
120	0	-0.065	-3.5				
3 hrs	0	-0.30	-4.0				
7 hrs	0	-0.55	-4.0				
21 hrs	0	-0.5	-5.0				
47 hrs	>0	-12	-6				
68.25	-0.015	-0.05	-5				

APPENDIX G

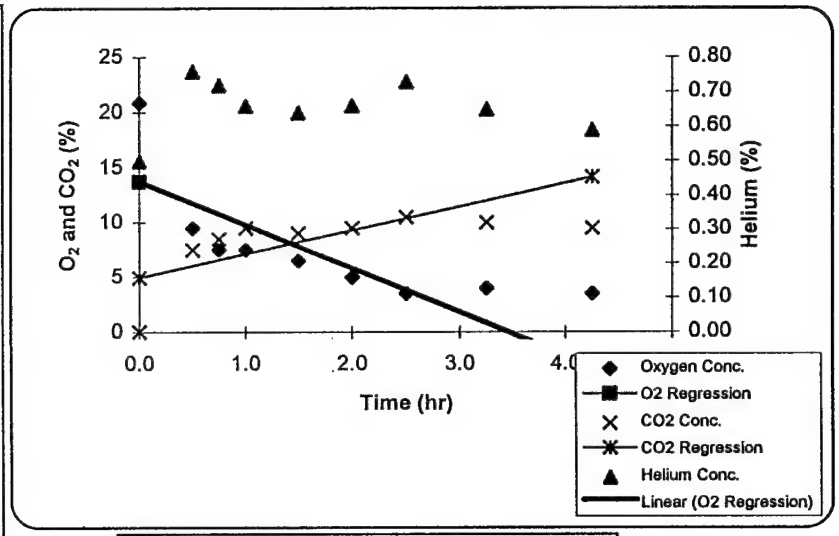
IN SITU RESPIRATION TEST RESULTS

In Situ Respiration Test

Date: 12/22/95 **Site Name:** McGuire AFB, NJ

Monitoring Point: MPA-6 **Depth of M.P. (ft):** 6

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.90	0.05	0.50
11/17/95 14:00	0.5	9.50	7.50	0.76
11/17/95 14:15	0.8	7.50	8.50	0.72
11/17/95 14:30	1.0	7.50	9.50	0.66
11/17/95 15:00	1.5	6.50	9.00	0.64
11/17/95 15:30	2.0	5.00	9.50	0.66
11/17/95 16:00	2.5	3.50	10.50	0.73
11/17/95 16:45	3.2	4.00	10.00	0.65
11/17/95 17:45	4.3	3.50	9.50	0.59



O_2 Utilization Rate

Ko	0.066	%/min
	3.979	%/hr
	95.497	%/day

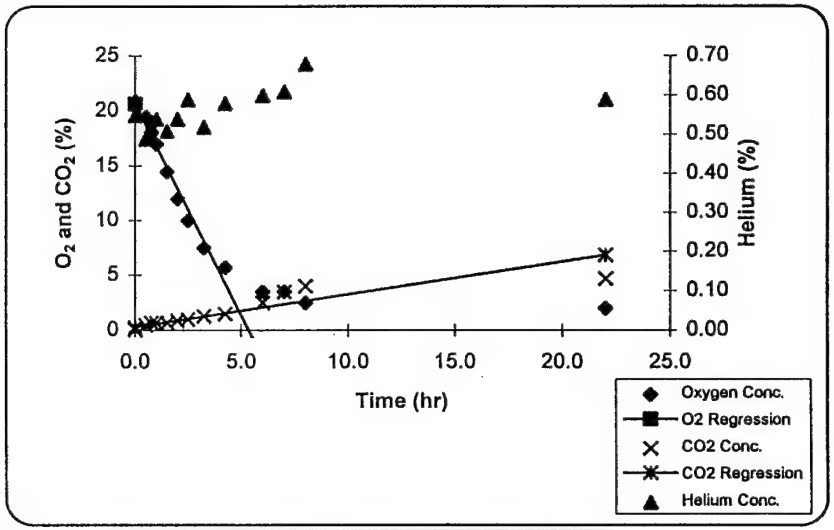
Regression Lines	O_2	CO_2
Slope	-3.9790	2.1674
Intercept	13.7699	4.9531
Determination Coef.	0.6098	0.4936
No. of Data Points.	8	8

In Situ Respiration Test

Date: 12/27/95 **Site Name:** McGuire AFB, NJ

Monitoring Point: MPB-9 **Depth of M.P. (ft):** 9

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.90	0.05	0.55
11/17/95 14:00	0.5	19.50	0.50	0.49
11/17/95 14:15	0.8	18.00	0.70	0.52
11/17/95 14:30	1.0	17.00	0.70	0.54
11/17/95 15:00	1.5	14.50	0.70	0.51
11/17/95 15:30	2.0	12.00	0.90	0.54
11/17/95 16:00	2.5	10.00	1.00	0.59
11/17/95 16:45	3.2	7.50	1.30	0.52
11/17/95 17:45	4.3	5.70	1.50	0.58
11/17/95 19:30	6.0	3.50	2.50	0.60
11/17/95 20:30	7.0	3.50	3.50	0.61
11/17/95 21:30	8.0	2.50	4.00	0.68
11/18/95 11:30	22.0	2.00	4.70	0.59



O_2 Utilization Rate

Ko	0.064	%/min
	3.859	%/hr
	92.605	%/day

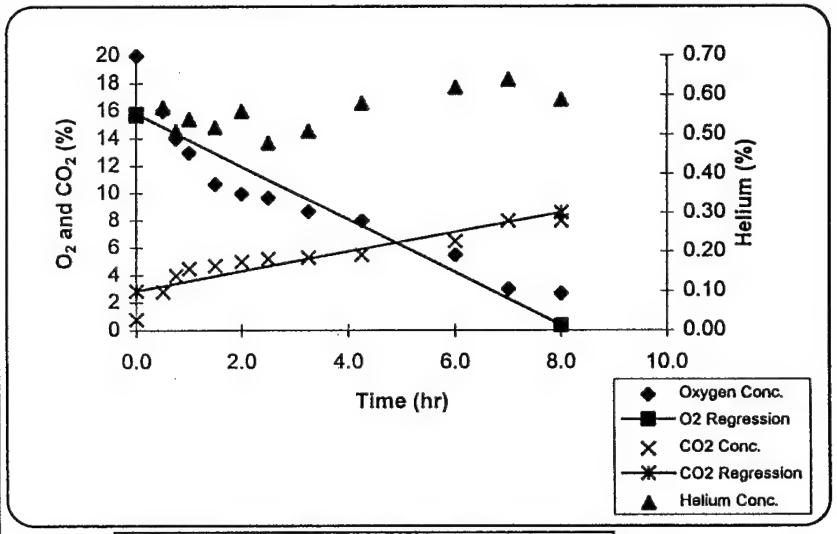
Regression Lines	O_2	CO_2
Slope	-3.8585	0.2967
Intercept	20.6524	0.2974
Determination Coef.	0.9776	0.9210
No. of Data Points.	9	9

In Situ Respiration Test

Date: 12/27/95 **Site Name:** McGuire AFB, NJ

Monitoring Point: MPC-6 **Depth of M.P. (ft):** 6

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.00	0.80	0.55
11/17/95 14:00	0.5	16.00	2.80	0.57
11/17/95 14:15	0.8	14.00	4.00	0.51
11/17/95 14:30	1.0	13.00	4.50	0.54
11/17/95 15:00	1.5	10.70	4.70	0.52
11/17/95 15:30	2.0	10.00	5.00	0.56
11/17/95 16:00	2.5	9.70	5.20	0.48
11/17/95 16:45	3.2	8.70	5.30	0.51
11/17/95 17:45	4.3	8.00	5.50	0.58
11/17/95 19:30	6.0	5.50	6.50	0.62
11/17/95 20:30	7.0	3.00	8.00	0.64
11/17/95 21:30	8.0	2.70	8.00	0.59



O_2 Utilization Rate

Ko	0.032	%/min
	1.930	%/hr
	46.323	%/day

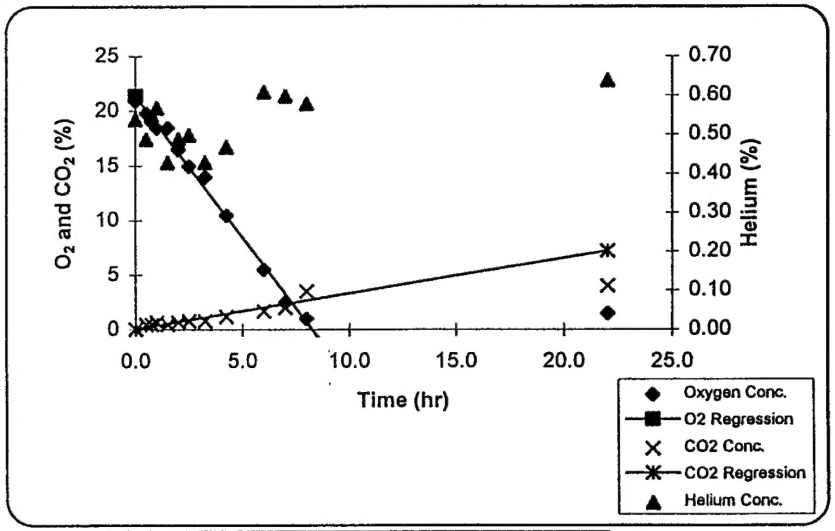
Regression Lines	O_2	CO_2
Slope	-1.9301	0.7170
Intercept	15.8265	2.8804
Determination Coef.	0.8559	0.7803
No. of Data Points.	11	11

In Situ Respiration Test

Date: 12/27/95 **Site Name:** McGuire AFB, NJ

Monitoring Point: MPC-9 **Depth of M.P. (ft):** 9

Date/Time (mm/dd/yr hr:min)	Time (hr)	Oxygen (%)	Carbon Dioxide (%)	Helium (%)
11/17/95 13:30	0.0	20.90	0.05	0.54
11/17/95 14:00	0.5	19.80	0.50	0.49
11/17/95 14:15	0.8	19.00	0.50	0.55
11/17/95 14:30	1.0	18.50	0.70	0.57
11/17/95 15:00	1.5	18.50	0.50	0.43
11/17/95 15:30	2.0	16.50	0.70	0.49
11/17/95 16:00	2.5	15.00	0.80	0.50
11/17/95 16:45	3.2	14.00	0.80	0.43
11/17/95 17:45	4.3	10.50	1.20	0.47
11/17/95 19:30	6.0	5.50	1.70	0.61
11/17/95 20:30	7.0	2.50	2.00	0.60
11/17/95 21:30	8.0	1.00	3.50	0.58
11/18/95 11:30	22.0	1.50	4.00	0.64



O_2 Utilization Rate

Ko	0.043	%/min
	2.591	%/hr
	62.178	%/day

Regression Lines	O_2	CO_2
Slope	-2.5907	0.3239
Intercept	21.4092	0.0872
Determination Coef.	0.9933	0.8661
No. of Data Points.	12	12

ABB ENVIRONMENTAL SERVICES, Inc.

08BS128

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 106.39
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/06/91	**Finish Date** 02/06/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 36.3	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 36.3	**Depth to Water (ft)-Date** 9.00 - 02/06/91	**Piez. Boring Well** ☐ ☒ ☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (FT.)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.0/2.0		1/2/2/4	4		0.0-2.3: TOPSOIL; Coal Ash; Refuse.	FILL		BKG	BKG		
	S-2 2.0/2.0		10/9/6/7	15		2.3-4.0: Brown Silty fine to medium SAND; trace coarse Sand.	SM		BKG	0.8		
5	S-3 1.5/1.5		7/11/13	24		4.0-4.4: Black to dark brown organic SILT; roots; grass.	OL		5.7	BKG		F
	S-4 1.5/1.5		10/6/8	14		4.4-16.0: Tan to gray to black stained SAND; well graded; some Silt laminae; organic Silt layer at 14.3 to 14.5 feet.	SP		1.8	0.8		F
	S-5 2.0/2.0		14/9/29/24	38			SP		307.0	50.3		F
10	S-6 1.5/1.5		6/14/20	34			SP		6700	490.0		F
	S-7 1.4/1.5		10/13/22	35			SP		870.0	440.0		F
	S-8 2.0/2.0		2/4/8/11	12			SP		26.4	307.0		F
15	S-9 2.0/2.0		10/11/13/18	24			SP		5.2	97.2		
20	S-10 1.8/2.0		10/12/14/10	26		Dark brown organic SILT; trace fine Sand.	OL		BKG	94.0		F
25	S-11 2.0/2.0		4/11/6/15	17		25.0-25.3: Similar to S-10 25.3-27.0: Black to dark green Clayey fine SAND; medium Sand laminae; wet.	SC		BKG	18.1		
30	S-12 2.0/2.0		1/5/7/12	12		Similar to S-11 (25.3-27.0); fossilliferous.	SC		0.8	4.9		
35	S-13 1.3/1.3		14/20/50	70		Similar to S-12; hard calcareous layer at bottom causing refusal at 36.3 feet.	SC	1	2.4	9.8		L
						BOTTOM OF EXPLORATION AT 36.3 FEET						
40												

NOTES:
1. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS129

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Ele** 106.45
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 01/14/91	**Finish Date** 01/15/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"
Soil Drilled (ft) 37.0	**Rock Drilled (ft)** N/A	**Ttl Depth (ft)** 37.0	**Depth to Water (ft)-Date** 9.00 - 01/15/91	**Piez.** ☐ **Boring** ☒ **Well** ☐

DEPTH(FEET)	SAMPLE NO., & RECOVERY / PENETRATION(FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 2.0/2.0		WOH/3/3/5	8		0.0-0.2: TOPSOIL	SM		BKG	0.7		L
	S-2 2.0/2.0		9/8/5/5	13		0.2-14.5: Tan to gray to black stained Silty fine SAND; trace medium and coarse Sand; black laminae; wet below 9.0 feet.	SM		BKG	0.5		L
5	S-3 1.5/1.5		8/18/30	48			SM		BKG	4.3		
	S-4 1.5/1.5		8/27/42	69			SM		BKG	4.2		F
	S-5 1.5/1.5		9/31/40	71			SM		BKG	4.0		
9	S-6 1.5/1.5		14/20/39	59			SM		BKG	6.1		L
	S-7 1.5/1.5		17/23/32	55			SM		BKG	10.0		F
15	S-8 1.5/2.0		4/14/42/48	56		14.5-16.0: Gray Silty fine SAND; bark fragments.	SM		BKG	0.8		
20	S-9		3/3/5/9	8		Dark brown Silty fine SAND; wet.	SM	1	BKG	0.7		
25	S-10		2/7/10/10	17		Black to dark green Silty fine SAND; trace coarse Sand; wet.	SM		BKG	0.5		
30	S-11 1.5/2.0		9/15/20/10	35		Blue-green Clayey fine SAND; fossilliferous; little medium Sand; damp; dense.	SC		BKG	0.2		
35	S-12 1.5/2.0		17/17/21/35	38		Similar to S-11; some coarse Sand.	SC	2	BKG	0.8		L
40						**BOTTOM OF EXPLORATION AT 37.0 FEET**						

NOTES:
1. Recovery/penetration not recorded for S-9 and S-10.
2. Boring backfilled with high solids bentonite grout.

ABB ENVIRONMENTAL SERVICES, Inc.

08BS130

Project McGUIRE AIR FORCE BASE RI/FS		**Site** McGUIRE AFB		**Project No.** 6623-04
Client HAZWRAP		**Logged By** SJC	**Checked By**	**Ground Elev** 112.16
Drilling Contractor MATHES OF NEW JERSEY	**Driller's Name** MIKE LOGAN	**Rig Type** D-50	**Start Date** 02/21/91	**Finish Date** 02/21/91
Drilling Method Hollow Stem Auger	**Protection Level** MOD. D	**P.I.D. (eV)** 10.2	**Casing Size** N/A	**Auger Size** 4.25"

Soil Drilled (ft)	Rock Drilled (ft)	Ttl Depth (ft)	Depth to Water (ft)-Date	Piez.	Boring	Well
16.0	N/A	16.0	12.00 - 02/21/91	☐	☒	☐

DEPTH (FEET)	SAMPLE NO. & RECOVERY / PENETRATION (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	NOTES ON DRILLING	P.I.D. PPM: PI METER FIELD SCAN	P.I.D. PPM: PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-1 1.2/2.0		7/3/2/3	5		0.0-5.1: Green to black fine to medium SAND; concrete fragments; damp; fuel odor.	SP		BKG	777.0		F
	S-2 1.4/2.0		8/8/8/12	16			SP	1	BKG	0.5		F
	S-3 1.7/2.0		9/10/9/10	19			SP		BKG	3.0		
5						5.1-12.0: Green to black to brown Silty fine SAND; mottled; damp.	SM					
	S-4 1.9/2.0		6/10/12/10	22			SM		BKG	8.0		
	S-5 2.0/2.0		3/6/5/6	11			SM		BKG	BKG		
10	S-6 2.0/2.0		1/2/3/10	5			SM		BKG	0.2		
	S-7 2.0/2.0		6/12/15/8	27		12.0-16.0: Light gray SAND; well graded; wet.	SP		BKG	2.3		L F
15	S-8 2.0/2.0		3/8/9/10	17			SP	2	BKG	2.8		L F
20						**BOTTOM OF EXPLORATION AT 16.0 FEET** NOTES: 1. Auger refusal at 2.0 feet. Moved to new location twice. 2. Boring backfilled with high solids bentonite grout.							
25												
30												
35												
40												